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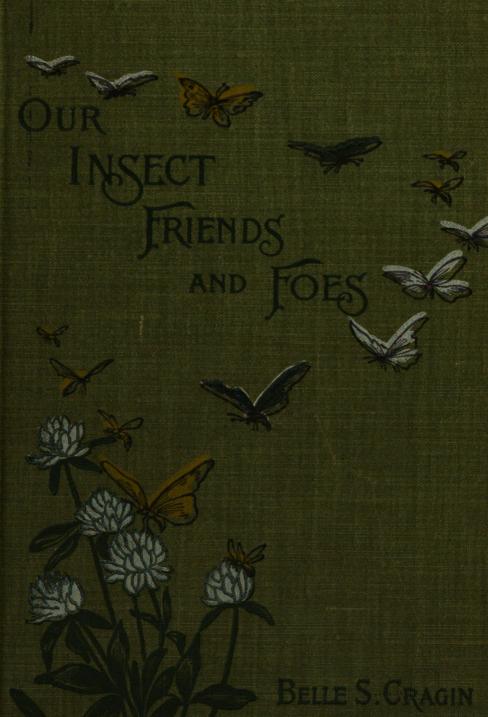
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#### OUR INSECT FRIENDS AND FOES



# OUR • • INSECT • FRIENDS • AND FOES

HOW:TO COLLECT PRESERVE AND::: ::STUDY THEM::

BY

BELLE S. CRAGIN, A.M.

WITH 255 ILLUSTRATIONS

G. P. PUTNAM'S SONS NEW YORK & LONDON The Knickerbocker Press 1899 COPYRIGHT, 1899
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Entered at Stationers' Hall, London

The Knickerbocker Press, Rew Pork



#### **PREFACE**

A BOY of eleven once asked me, in the midst of a schoolroom talk on the uses of participles, where a grasshopper's ears were. By what circuit he had travelled from participles to grasshoppers I do not know, but he had been so absorbed in his own thoughts that he met with a sort of dazed indignation the irrepressible titter that ran round the class. I did not wonder that he found grasshoppers more interesting than participles,-I do myself,—and so, I am sure, do the young people for whom, most of all, this book has been writ-That participles have their uses, and must be given a share of our attention, I should be among the last to deny, but grasshoppers, and their hopping, crawling, swimming, flying kin of the insect world can teach us more lessons than ever were packed between the covers of a grammar, or of any other printed book. There are many kinds of books, you know, and those we find in Nature's school-room are far from being the last in interest or profit.

When you study insects you will learn in what marvellous ways their structure is fitted to the surroundings amid which they live, and how their habits have changed as the conditions of life have changed during past ages; you will be amazed at their strange instinct, so close in some of its manifestations to what we call reason; you can not fail to see how important a part is borne by insects in the economy of nature, and how closely related are insects, plants, and birds, or entomology, botany, and ornithology. You can scarcely travel one road without finding your feet in by-paths that lead to others, each delightful and profitable in its own way.

The weightier and more practical matters of life must not be omitted or slighted, but health and pleasure, useful habits of observation and research, a mind to which evil thoughts are alien and distasteful, are Nature's gift to those who follow her with an honest, loving spirit.

No attempt has been made in these pages to mention any except the commonest species of insects, nor all of those. The habitat, in most cases, is included in the description, but, as a rule, the species are those found in the States east of the Rocky Mountains and north of the Gulf States. The scientific names are given for such insects as are illustrated, and in addition you will find at the end of the book a list of popular names and their scientific equivalents. I recommend that you make yourselves familiar with the latter, because popular names are often inaccurate, being applied without much regard to entomological principles. Scientific names are also subject to occasional change, but generally for good reason. There are published what are called by naturalists "check-lists," which give these changes, so that it is not difficult to keep yourself informed.

In my younger days, when nature-study was unknown in schools, and my problems had to be solved by my own investigations or remain unsolved, I used to long for somebody to write a book that would tell me the things I wished to know, or show me how to find them out for myself; and that is what I have tried to do for you. How far the purpose has succeeded you must decide,—but if it has quickened your interest in the study of insects; if it has an-

swered any of your questions, or led you to ask more; if, above all, it has encouraged you to personal research, I shall be satisfied.

Belle S. Cragin.

Sherborn, Mass., May, 1899.



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Thanks are due to the publishers of these works for permission to utilise these designs.

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# OUR INSECT FRIENDS AND FOES

In making an entomological collection, it is important to catch the insects in the right way, so that they shall be as nearly as possible perfect in condition. Specimens with Introductory. faded colour, broken legs, bruised wings, or missing antennæ have few attractions for a scientist, young or old.

Having caught your insects, you must know how to mount and preserve them, following certain rules agreed upon by entomologists, so that your specimens shall be individually fit either for study or for exhibition, and so that your collection as a whole shall be valuable and attractive.

Perhaps the most generally useful part of a collecting outfit is the poison bottle.

This you can buy for about twenty-five cents, or you can have it prepared as follows. Take a white glass bottle

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#### 2 Insect Friends and Foes

with a wide mouth, or even a common tumbler. Fit it with a close cork, thick enough to leave a considerable portion above the edge of the glass for convenience in removing. You will often wish to take out the cork in a hurry, and you will sorely grudge time wasted if you have to pry it out. In the bottom of the bottle place a few small lumps, perhaps an ounce, of cyanide of potassium, handling it with great care, for the fumes are extremely poisonous. The odour is disagreeable and very penetrating. It is hardly possible to close the bottle so tightly that the odour of the cyanide can not be detected about the cork. pearance, this deadly poison is a white solid, not readily distinguishable from one of several harmless substances; so if you have any surplus, burn or bury it. It is better not to have a surplus.

Over and around the cyanide sprinkle fine dry sawdust to the depth of half an inch. Mix a little plaster of Paris with water, not too thin, and pour over the sawdust to about the same depth. It will "set," or harden, quickly, and your collecting-bottle is ready for business. An insect dropped into it will die in a short time, without apparent suffering and without injuring his appearance. Melted beeswax also makes

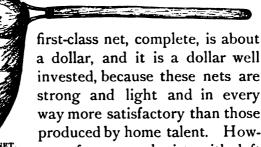
Net 3

a good covering for the cyanide, but it is not so generally employed as plaster of Paris. From time to time moisture will gather in the bottle, and must be removed with blotting-paper.

This bottle may be used for bugs, beetles, spiders, flies, grasshoppers,—anything sufficiently small to pass easily through the mouth of the bottle, and this includes nearly all common insects except some dragon-flies and the larger moths and butterflies.

Cyanide will lose its strength, and can not be depended on for more than one season's work.

For larger insects you will need a net with a stiff rim and a handle. Such nets are for sale by taxidermists, from whom Net. you can buy all supplies for collecting and preserving insects. The price of a



strong and light and in every way more satisfactory than those produced by home talent. However, for entomologists with deft

fingers these directions will be useful.

#### 4 Insect Friends and Foes

Take a piece of mosquito-netting (or any similar material), green or brown, that the net may not be conspicuous by its colour, and shape it into a bag eighteen or twenty inches deep. It should not be less than this, and may be a little longer if desired, because, when the net has fairly settled over a prisoner, you must give it a quick turn to prevent his escape, which you can not do if it is too short. Round off the bag at the bottom, for corners are likely to catch and tear, and also give the little captive more room to batter himself and spoil his good looks. The top should be turned down several thicknesses to make it firm.

The ring should be about twelve inches in diameter; it will be then a little less than thirty-eight inches in circumference. If your material is one and one-sixth yards across before making up, your net will be of the right size, with a good allowance for seams. The seams must be deeper than in ordinary sewing, and should be sewed on one side and then turned and sewed on the other, into what is called a "French" seam.

The ring should be of telegraph wire, No. 3. Take a piece fifty-four inches long, and form it into a hoop, with five inches of each end bent at right angles, and parallel to each other, in

this shape, Q, and tie the ends firmly to the end of the handle, one on each side. Make them more secure by staples or double-pointed tacks. This is the simplest way, and, I must add, the least satisfactory. The staples will keep the ring from twisting, but they will not keep it from pulling out, as it will almost certainly do some time. It is wiser, therefore, to take more trouble at first and have less at last.

A better way is to bore a hole crosswise through the end of the handle, run the ends of the wire through from opposite sides, bend them back along the handle, and secure them as before.

Directions for making a rattan rim are given in a little pamphlet issued by Denton Bros., Wellesley, Mass.

"Take a piece of rattan rather thicker than a lead pencil, and bend it into a hoop; bevel the ends and fasten them together by winding with fine iron wire. Bore two holes, four inches deep, lengthwise in one end of the net handle. Take two pieces of rattan, each one foot long, and drive them into the holes, using a little glue to fasten them. Make a long bevel on the ends, groove them out a little, spread them apart, and wire the rattan hoop to them. The whole should then be given a coat

of shellac. The pieces of rattan will bend better if soaked for an hour in hot water."

I have not tried this, but it looks easy, except perhaps the boring of two four-inch holes lengthwise in the handle. I would suggest, also, the use of copper wire instead of iron. It is less brittle, and it will not rust. The grooves and bevels should be carefully adjusted to give the rim the proper rigidity. To bevel the ends is to cut them off at an angle instead of straight across, so that they meet in a long, slanting joint.

The handle may be of pine, or any light, straight-grained wood, perhaps an inch in diameter, and three, or three and a half, feet long. If you are going to bore lengthwise holes in it, you had better use hard wood. I have seen broom handles, and even rake handles, utilised for this purpose. They are larger than is necessary, and heavy in proportion, but they will answer if you can find nothing better.

Cover the ring with stout cloth, and sew the edge of the net to it with strong thread, such as carpet thread or coarse linen from your mother's basket, and the net is complete.

The collecting-bottle and the net are the two essentials for catching insects. From the net

they may be transferred to the bottle, or, if the captive is a butterfly or a moth, it may be killed quickly and painlessly with

a dose of chloroform. Carry a How to Kill Specimens.

an ounce—as part of your outfit, and when you wish to use it, hold the insect lightly in a fold of the net, and drop a very little, not upon its head, but upon its side—under the wing if you can manage it, for insects breathe through their sides and not through their mouths. You may, if you prefer, apply the chloroform with a camel's-hair brush.

The bottle should be kept tightly corked when not in use, to prevent the contents from losing their strength, and should be labelled "Poison," to guard against accident. Chloroform looks precisely like water. It has a pungent, sweetish odour, and when applied to the skin feels first cold and then hot, very hot. It is well to be extremely careful not to leave the bottle about, especially within reach of little children.

But whatever you use, cyanide or chloroform, be sure that your specimen is dead before you mount it, and if any sign of life appears after it has been pinned, return it at once to the bottle, first removing the pin to prevent its corroding. Insects have not the complicated nervous system that higher animals possess, but of course we have no right to cause them needless fear or pain.

When you go out on a collecting trip you should take Collecting-Papers. with you a supply of collecting-pa-COLLECTING-PAPER. pers, for carrying your specimens safely home. These are simply oblong slips, twice as long as wide, cut from newspaper or any reasonably stiff, tough paper. Holding the slip horizontally, fold the right end down in front at the point e, which point is one-fourth the distance from a to b. Then fold the end a-c over to the FIG. 3. COLLECTING-PAPER. right, and turn the

corner a down at the back; also, turn the

end b-d up at the back, and turn the corner d

down in front. The paper will then be triangular in shape, and its contents will be secured against dust and dampness. Un-

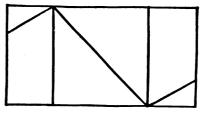


FIG. 4. COLLECTING-PAPER.

folded, the slip will be creased somewhat like this.

These slips may be of any size. Three and a half inches by seven is a good size, but some should be larger and some smaller, keeping the proportion about the same.

An insect may be left in the cyanide bottle until stupefied, then folded in one of these papers and returned to the bottle, or a touch of chloroform will quiet it, so that you can fold it in the paper and drop it into the bottle, where the cyanide will complete the work. In this way you can carry several specimens in the bottle at a time.

If you are making a long trip, and likely to be absent for some time from your base of supplies, a larger bottle may be prepared, a pint or a quart glass jar, always replacing the cover by a cork. There is a collecting-box,

#### Insect Friends and Foes

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with shoulder-strap, sold for about a dollar and seventy-five cents,—a good thing to have, but not essential. If your specimens are well secured in the papers, they can be carried safely in small boxes. Be sure to write on the outside of each paper the date when the specimen was caught and the place where you found it.

To mount or set your insect you will need pins and blocks or boards. Never use common pins. Insect pins come in sizes Mountingfrom 000 to 8, of uniform length, with Outfit. fine points and inconspicuous heads. Klaeger's one-and-three-eighths-inch, No. 3, is best for general use; Nos. 1 and 5 next; but the wisest purchase for a beginner is a fifteencent package of one hundred assorted pins. You can buy two hundred of any size for twenty-five cents, or one thousand for a dollar. They may be had either black or white, and it is of small importance which you use. The black are said to have one advantage over the white. Nearly all pins have brass in their composition, and it sometimes happens that a green corrosive substance forms on the pin where it passes through the body of the insect, spoiling the beauty of the specimen. The enamel with which the black pins are coated is said to prevent this corrosion. On the other hand, they have had the reputation of bending easily, but a "Klaeger's special" is now on the market, said to be stiffer than any white pin.

For blocks use soft pine, flat and perfectly smooth, perhaps an inch thick and two or three inches square. Make a groove one-fourth of an inch in width and the same in depth, across one surface of the block, preferably at right angles to the grain of the wood. It is liable to split if made the other way. Use a jack-knife or a gouge. In the centre of the groove bore a small hole, and crowd into it a fragment of cork. This is to hold the pin upon which the insect is impaled, and a little experience will teach you how firmly to wedge it into the hole. If too loose, it will come out with the pin; if too tight, it will be so compact that you will be likely to bend the pin in pushing it in, which is often disastrous, because the insect in drying adheres to the pin, and if loosened is not readily made to stay in place again.

If you prefer you can use a setting-board instead of blocks. This is made on the same principle; a board of any convenient size, grooved, with holes at intervals in the grooves. Or you can use a thinner board, raising it to the necessary height by cross-pieces glued un-

derneath at either end. It needs to be only high enough to keep the pin-points from touching anything below the board. The setting-board can be made in strips instead of a solid piece. The strips should be nailed to crosspieces. A space should be left between each two slats, and a thin, narrow sheet of cork tacked over the space underneath. I have seen boards made in this way, with the strips raised a trifle at each outside edge by small wedges, so that an insect mounted upon it would dry with the wings sloping slightly upward from the body. This was done to counteract any possible downward droop of the wings when taken from the board.

You can, if you wish, buy setting-boards, called by dealers "spreading-boards," at twelve cents for a six-inch board, and twenty-five cents for a twelve-inch. These have the bevel or sloping top, and come with grooves or slots of different sizes.

It is a common thing now to mount insects upside down. To do this take a perfectly flat, smooth board, with very small holes bored in it to allow the head of the pin to go in out of harm's way. This is an excellent method.

Having your pins and boards ready, provide

yourself with setting-needles—fine steel needles with handles improvised from short sections of a match,—some fragments of heavy window glass, a small, wide-mouthed bottle of white shellac, and a pair of curved forceps for pinning. Another pair for handling insects is sometimes used. Careless or awkward fingers often make havoc with brittle legs and antennæ, but the same fingers might be equally destructive if armed with forceps. If you are buying these instruments choose a pair with broad, smooth inside surfaces. There are also collecting-forceps which have fine points, straight or curved; but a beginner does not need them. Setting-needles with glass handles may be bought, but are no better than the home-made. Your outfit should also include a few vials and pill-boxes for carrying home small specimens.

Let us take first a butterfly or a moth. The body of an insect is made in three sections, head. chest, or thorax, and abdomen.

Place the point of the pin at the centre of the thorax and push it in unstil about three-eighths of an inch remains above the back. Turn the insect round and look at it from every side, to make sure that the pin is

perpendicular. Then grasp it firmly near the point with the curved forceps, and push it into the cork; move the forceps up a very little and push it in farther; and so on until the body of the insect rests in the groove and its wings touch the board. If you seize the pin too high up at first, you will probably bend it and perhaps ruin your specimen. If the body will not go into the groove so as to let the wings lie absolutely flat on the surface, the groove is too small and you must exchange your block for one better suited to the size of the insect.

See that the legs of the specimen are tucked pretty well under the body. They are thus less liable to be broken, and as they are of little use in identifying specimens, they do not need to be displayed. With a setting-needle spread the front wings so that their hind edges are at right angles to the body, and bring the hind wings up until they meet the front ones. Arrange the antennæ to lie along the front edges of the front wings. In using the setting-needles be careful not to tear the wings, but place the needle against one of the stouter veins or nerves, generally the costa—that is, the one extending along the front margin of the wing.

When the butterfly is spread as you wish it, lay pieces of glass carefully on the wings and antennæ, and remove the setting-needles. The glass must rest on the tips and edges of the wings, or they will not dry smooth and flat. It is not so important to cover the stiff part of the wing near the body. The setting-needles should not be allowed to remain until the wing is dry, because they are likely to tear it when removed. Some collectors use, instead of glass, strips of cardboard, secured by pins or needles at the ends; and I have seen the same purpose served by winding thread round and round both block and insect, but glass is best in every way.

Whether you mount the butterfly right side up or wrong side up, take great care not to rub the surface of the wings. They are easily marred, as every country child knows; the slight touch of a careless finger will take off many of the tiny scales which cover the wings and give them strength and beauty.

The foregoing directions apply as well to moths as to butterflies, except that moths have short, thick bodies, and require a larger groove than butterflies, if you mount them right side up; if you mount the other way you need no groove.

If the specimen is a beetle, the insect-pin should not be put through the thorax, because the thorax of beetles is one of the most important aids to classification. These insects should be pinned through the right wing-cover, or el'ytron. Bugs, which are not beetles, though many people do not know the difference, should be pinned through the little horny triangle at the base of the wings, called the scutel'-lum; most other insects—flies, bees, grasshoppers, dragon-flies—should be pinned through the thorax, like moths and butterflies.

There are, however, still other insects too tiny to be pinned at all, some of them not much wider than the pin itself, even though that be a No. 000. For these many entomologists use a triangle of white cardboard, threeeighths of an inch across the base, one-eighth of an inch from the middle of the base to the apex. Put the pin through the base, turning the apex to the left, and glue the insect to the card near the apex, with his head toward the top. Other collectors use, instead of triangles, tiny disks or circular slips. For my own use I prefer these. They can be bought for seventyfive cents a thousand, or you can buy for three dollars a punch which will cut all you need. you make your own slips with no better tool than a pair of scissors, you will probably choose the triangles, for good reasons.

For glue use the white shellac with which I told you to provide yourself. This shellac is also used for mending broken or detached legs, antennæ, etc. Sometimes the mending becomes quite an art, as when an insect which has lost one or more members is supplied with those of another insect which has no further use for them itself: or when an insect is almost constructed from the remains of others like it. Such a piece of construction is possible, for a deft and observant entomologist. It is advisable, however, not to repeat the experience of a little friend of mine. Two beetles of different kinds, which he had put into a box together overnight, tried to eat each other up. They so nearly succeeded that the boy had on hand, in the morning, only an assortment of lifeless fragments. With more zeal than knowledge, he proceeded to reconstruct these; and the result was a creature with the body of one beetle and the head of another; and the head was upside down.

When the insect is mounted to your satisfaction on the block or board, put it away in a dry place. It will need two or three days to dry thoroughly, and for insects with stout, soft

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bodies a week will be needed. It is easy to make a mistake, especially if the insect has large wings; they will often curl or droop when taken from the board. So it is best to be on the safe side. If you live in a very damp climate, you will need to dry your specimens artificially, in order to prevent mould and decay. For this, use the drying-oven described later.

For temporary purposes pasteboard boxes, floored with cork or peat, can be used. Envelope boxes are of good size, but anything will do which is so deep that the cover, when it warps, can not touch the specimens. For the same reason do not pin them too near the sides. Dried insects are very brittle. Still better than pasteboard are cigar boxes, because they will not warp, but they are not air-tight and therefore not suitable for permanent use.

Cork comes in sheets four inches by twelve, about one-fourth or one-eighth of an inch thick, and the price varies from thirty-five cents to a dollar and twenty-five cents per dozen. Peat comes in sheets of the same size, at thirty-five cents a dozen. For most uses it is quite as good as cork. Sew or glue the sheets to the bottom of the box.

When your specimen is ready to put away, set the pin in the cork with the forceps. If you cut down the corners of the box, and close them, after filling it, with strips of strong cloth pasted over, you can get along without the forceps, using instead a pair of slender, flatnosed pliers, bought for about twenty cents at the hardware store. Grind off the corners a little, and you will like them better. These can be used, also, for setting insects on blocks, but sooner or later you will need the forceps. They are expensive; the best cost two dollars and a half, and you can hardly buy any for less than a dollar.

For permanent storage, tight wooden boxes are indispensable, and it is better to use them from the first. Of course the finest thing is a naturalist's cabinet, a handsome piece of furniture with many little drawers of just the right size and depth, making a beautiful display of specimens, and yet keeping them in the safest possible way. But a cabinet like this is far beyond the reach of most of us, and we must content ourselves with boxes. Store boxes, three and a half by ten by fourteen inches, are made of pine in different grades, with hinged covers, and range in price from fifty cents upward. Cases with glass tops, three

and a half inches by nine and a half by thirteen and three-fourths, are made of hard wood, lined with cork and papered inside. These cost about a dollar and a half. The cases are intended for exhibition purposes, and the store boxes for storing specimens. Other boxes are made to represent a book hinged at the back, and containing a case with glass sides. These cost seventy-five cents or more, but they can be made by one who has a talent for such work. Elsewhere I have given directions for making them, and if you succeed you will save considerable expense.

In arranging your specimens, either for exhibition or for storage, do not crowd them. Crowding increases the danger of breakage in handling, and the effect of a collection for exhibition is far better when the specimens are separated by a considerable space.

Insects have a great many enemies when they are alive and they do not escape them all when they are dead. The worst enemy is the larva of a very tiny beetle, called Anthrénus. The beetle himself is less than an eighth of an inch long, and he will find his way into any box not air-tight. The eggs are laid on the specimens, and the fat,

hairy little larvæ will soon destroy the collection if not themselves destroyed first. So if you are obliged to use pasteboard boxes at all, you must watch them closely and transfer the contents to the wooden boxes as soon as possible. Do not open any box unnecessarily, and on no account leave one open when you are absent, even for a short time. When you have once made the acquaintance of Mr. Anthrenus, and his astonishing adroitness in getting at your collection, you will understand better why I make this caution so imperative.

As a final safeguard against him, put into each box about four disinfecting-cones, one near each corner. They cost about a cent and a half each, by the dozen, and only half as much by the hundred. They are very convenient, and their odour is so bad that even Mr. Anthrenus shrinks from encountering it. Still, he sometimes ventures, in spite of it. Eternal vigilance is the price of a good many things, and if some day you see in your collection a few grains of what looks like very fine brown dust, do not wait for further hints. Mr. A. has arrived and is munching away inside of the specimen under which you see the dust. Buy a little carbon bisulphide, pour a few drops into a small dish, set it into the case, shut the case up tight, and go away. You will be glad to go away, for the odour of carbon bisulphide is appalling. Moth-balls and disinfecting-cones are fragrance compared to it, but it is deadly to insect pests, and in a day or two you may feel assured that your collection is freed from them. On account of its vile odour and its poisonous character you will not wish to keep it on hand. It is also very explosive, and its fumes must be guarded from the flame of a lamp or a fire. And finally it is so volatile—that is, it evaporates so freely—that if you kept any for future use you would probably, when you needed it, find nothing left but the smell.

Another enemy against which you must watch is mould. Keep your blocked specimens and your collection always in a dry place. During long periods of wet, warm weather dampness will sometimes creep into the tightest boxes. A little carbolic acid will generally prevent mould, but if it does appear, open the case at once and subject it and its contents to an even, *moderate* heat. A badly moulded specimen might as well be thrown away.

The corrosion of the pins, resulting from the brass in their composition, is another danger to a collection, but not so common or so serious as the others. It shows itself first as a tiny greenish excrescence on the insect's body where the pin passes through it; but it grows and grows until there is more excrescence than insect, and the whole must be thrown away. I know of nothing that will prevent or check it, but I think absolute dryness would help to do so.

It will sometimes happen that insects will stiffen before you are ready to mount them, so that you can not do it without risk of Relaxing breaking them. When you have **Dried** Specimens. raced the fields till dark, or have been on a night tramp after moths, you will not always feel inclined to sit down at once and mount your specimens. Also, as your collection grows, and your skill and enthusiasm grow with it, you will make exchanges with other col-Such exchanges will generally be dried and mailed in boxes in collecting-papers. To meet all these cases you should know how to "relax" your specimens. It can be done by filling a tin dish with sand, keeping it damp and warm, and laying the dried specimen on the sand, with a cover to keep in the moisture. For beetles and other hard-shelled insects this answers very well; but for delicate specimens

you must stretch a netting close above the sand, and lay the insect on that. A short time will often be sufficient to make it flexible, but if it is very dry it may take twenty-four hours or even longer. In that case put a few drops of carbolic acid on the sand to prevent mould. If you let the sand become dry or cold you will of course lose time, but do not try to hurry matters by bending the insect's members before they are entirely relaxed. If you do you will certainly regret it.

A relaxing-box is easy to obtain, and is much more satisfactory than a tomato-can full of sand. It is only a tight, covered box, five or six inches deep, of any convenient size, with about two inches of damp sand or sawdust in the bottom. You can stretch a netting over the sand for the specimens, or (and this plan I consider much better) you can make a deep, narrow furrow in the sand, line it with a fold of tissue paper, and slip the insect into it. In this way a large number can be relaxed at the same time. Large specimens or very dry ones will need more moisture than others, but on this, as on all other points, experience will be your best teacher, and you will soon learn the degree of moisture and the length of time required. It is well for a young entomologist to make

his first experiments on insects that are not very valuable, and this is true not only of relaxing, but of mounting and all other branches of the work.

When the appearance of mould in your collection makes it necessary to apply heat, the kitchen oven will be found a good place for the drying process, if you Drying-Oven.

But if you do not feel at liberty to carry your entomological pursuits into the kitchen, you can make a drying-oven for yourself.

Take a tin box with a hinged cover, perhaps a cracker box ten inches each way, lay it on the side so that the cover will answer for a door, and punch the top full of small holes with a wire nail or an ice-pick. In doing this you should have something solid under the surface you perforate, or you will jam and bend it out of shape. You will need a shelf of wire net across the middle of the box. The tinsmith can make this for you, or perhaps you are ingenious enough to do it yourself. All that is needed is a frame to hold the specimens well up from the floor of the box, and to allow the heat to pass freely among and around them. In the bottom of the box cut a round hole for

the top of a lamp chimney, and over the hole solder a tin cone, raised a little to admit air. The hole should fit the chimney as closely as possible. A common hand-lamp will complete the apparatus, except that the oven must stand high enough from the floor to accommodate the lamp. This can be accomplished by having legs soldered to the corners, or you can invent some other support; only there must be no woodwork about the oven. Do not take any risk of fire. For the same reason do not leave the lamp burning unwatched for any length of time.

Remove the specimens from the case with the forceps, stick the pins into sheets of cork or peat, and put them into the oven. Dry the inside of the case thoroughly before returning them.

This oven is also useful for drying specimens in localities where the climate is very moist, as suggested in How to Mount Specimens.

A good magnifying glass is not, at the outset, an absolutely necessary item of an outfit, but it is a highly desirable one, and if you are going to do any intelligent work in entomology it will soon become really essential. What is known as a Codding-

ton lens will answer for all ordinary investigation. It may be bought with two lenses, in a black rubber case, convenient and practical, for about half a dollar; or with three lenses for a little more. Get the latter if possible. You can pay a good deal more for fancy mountings, but if you have any money to spend in that way, you had far better save it and buy a compound microscope.

Some insects, notably the moth families known as Saturni'idæ, or Giant Silkworms, and Citheroni'idæ or Royal-moths, have bodies so large and fat that, Gasoline. in drying, the grease will ooze out and spoil the beauty of the specimen; and all the members of these families are very beautiful. The only way to get rid of this grease is to soak the insects in gasoline or benzine. Fill a shallow dish with the liquid, lay the specimens directly in it, and cover the dish. Let them stay a day and a night, or longer if necessary; then dry them thoroughly. Blow them a little to bring back their soft, fluffy look-for most of these fat-bodied moths are clothed with delicate hairs—and the specimen will be as handsome as ever. Inasmuch as gasoline and benzine are highly explosive,

you must do this work in a "large place," outdoors or with open windows; under no circumstances in a room with a lighted lamp or stove. Even friction will sometimes ignite these liquids. At the same time the work is quite safe if you always use proper caution in doing it.

I have told you now all that you need, and some things that you do not need, certainly at first, for collecting and preserving Summary of insects. There is one other item which is essential to success. You can not buy it, and yet you will probably think, in more than one case, that you have paid for it. I mean experience. You will not pay too much, however, if you are careful at first to follow directions exactly. These directions are all the result of the experience of others, and you can not make many expensive mistakes if you keep close to them.

For convenience I add a summary of the outfit as it has been described.

- 1. Collecting-Bottle.
- 2. Net.
- 3. Collecting-Papers.
- 4. Insect Pins.
- 5. Setting-Boards (or Blocks).
- 6. Setting-Needles.

- 7. Glass Fragments.
- 8. Pinning-Forceps (or Pliers).
- 9. Cork (or Peat).
- 10. Store Boxes.
- 11. Disinfecting-Cones.
- 12. Note-Book.
- 13. Collecting-Box.
- 14. Cardboard Slips.
- 15. Relaxing-Box.
- 16. Drying-Oven.
- 17. Magnifier.
- 18. Chloroform.
- 19. White Shellac.
- 20. Bisulphide of Carbon.
- 21. Collecting-Forceps (Fine Points).
- 22. Handling-Forceps (Broad Points).
- 23. Cases for Exhibition.

The first twelve articles on the list are indispensable to satisfactory work, even for a beginner; but Nos. 3 and 7 will cost nothing, No. 6 practically nothing, and none of the rest can be called expensive except the net and the pinning forceps, and the store boxes unless you make them. The next eight items you will need later; the last three you may or may not need, according to the degree of your persistence in entomological work. The note-book I shall speak of again. If you

wish to prolong the list you may add the punch for cutting slips, which you will never need unless you turn out to be a collector of exceptional energy and perseverance; labels, which you can make, or buy for from fifty cents to a dollar a thousand, according to size; also scalpel and curved scissors for dissecting large insects; but you will travel a long way on your entomological road before you can need or use these.

Scientific men have estimated that the animal kingdom comprises more than a million species, and it is believed that all The Insect these are descended and developed World. from certain very simple forms of animal life that existed in the early ages of the earth's history. Probably these earliest animals lived in the water, but the changing conditions of light, heat, and moisture upon the earth, as the ages of creation rolled by, produced in both plants and animals the changes necessary to fit them for those conditions; so that after a while, by gradual development, certain species became fitted to live on the land, and others to fly through the air. Insects, like the higher animals, have come to be divided naturally into the aquatic, those that live all the time in

or on the water; the semi-terrestrial, those that live in wet places, and are equally at home on land or water; and the terrestrial, those found only on land.

The great kingdom of animal life is classified as follows,-individuals are grouped into species, species into genera, genera into families, families into orders, orders into classes. classes into branches, sometimes called subkingdoms, and branches make up the animal kingdom. Some authorities give sixteen divisions, but most of us are satisfied with these eight. It is only by patience and practice that you will master the distinctions, but it is just as easy in the first place to do a thing right as to do it wrong, and I urge you strongly to learn the correct names for your specimens, and for the groups to which they belong, and to call them by those names. There is no reason, for instance, why we should call a certain familiar insect a "June bug," when he is not a bug, but a beetle, and his first appearance is in May; nor why we should speak of the "coral insect": for the little creature whose limestone frame helps to build up the coral reef is no more an insect than a fish is, or a cat.

Insects constitute one class of the animal kingdom, and there is no class more numerous.

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There are thought to be between one-fourth and one-half million different forms. Among these, the order *Hemip'tera*, including bugs and their near relatives, is estimated at ten thousand; the orders *Lepidop'tera* (moths and butterflies) and *Hymenop'tera* (bees, wasps, ants, etc.), at twenty-five thousand each; and *Coleop'tera* (beetles), at one hundred and twenty-five thousand! These are only estimates, but one hundred thousand species of beetles are actually named and catalogued; eleven thousand of them in America, north of Mexico.

Many insects are of great use to the human race. Bees make honey for our tables and wax for commerce. The silkworm, though a native of China, is raised in this country, so that it is familiar to most of us by reputation and to some of us by sight. The cochineal insect, found on certain species of cactus, furnishes a useful and harmless dye. The shellac which we use in preparing our collections is made by other members of the same family, and the ink with which I am writing is made from the galls of the gall-fly, a native of Asia. Certain insects are used in medicine, and others, in some countries, are prepared for food. Carnivorous insects destroy others which are injurious to animal or vegetable life, or they act

as scavengers and devour refuse and decaying matter on land or in the water, which if left untouched would load the air with disgusting odours and poisonous germs. Another use of insects, which most of us do not appreciate as we should if we knew more about it, is the cross-fertilisation of flowers,—that is, the fertilisation of one flower by the pollen from another. Winds and other agencies have a share in this necessary work, but it is done chiefly by insects, that, in extracting honey from one flower, load their bodies and legs with its pollen, which they brush off on the stigma of the next flower they visit.

As opposed to these and thousands more of useful insects, there are other thousands which are either not concerned with our happiness, or are actively engaged in trying to destroy it: such as the chinch-bug which infests grain; the Hessian fly which confines its attention to wheat; the Rocky Mountain locust which eats everything, even the bark off the trees; the gypsy-moth, against whose dreadful ravages the State of Massachusetts is making so determined and expensive a fight; the cabbage-root maggot and the onion-fly of our gardens, with hosts of others only too familiar to us all, to say nothing of clothes-moths and carpet-bee-

tles, and our own Mr. Anthrenus who has been called the "museum-pest."

Among the immense number of insects, many are interesting not only for their useful or noxious qualities, but also for their great beauty of colour or shape; others fascinate us because they are so curious or grotesque, or so intelligent; the habits of insects will reward the most diligent study; their changes or metamorphoses are wonderfully interesting. It is not surprising that more has been written about insects than about any other branch of the animal kingdom. At the same time there is no better field for original investigation, for many species have not yet been studied in detail, and much remains to be learned about the structure, habits, and relationships of insects in general.

I have given you elsewhere a list of books which will be helpful to you at different stages of your progress.

The easiest way is to start out with your net, poison bottle, and collecting-papers, and Where and collect anything that comes in your How to way. You will get considerable excroise and some good specimens in this way, but many you will never find unless you know their haunts and habits.

Butterflies fly by day and go to bed early, usually before five o'clock in the afternoon. You will sometimes find them in the dusk, asleep on leaves, in sheltered nooks of walls or fences, or clinging to twigs or the bark of trees. Neither do they rise early. They love the bright, warm midday, and retire from the shade and coolness of morning and evening. sunny clearings you will often find large butterflies, many of them the handsome "swallowtails," apparently playing tag, and so absorbed in it that you may easily take one or more captive. You will find others in large flocks around mud-puddles in the road, taking a drink. These also are easily captured. Certain blossoms are attractive to some; goldenrod, clover, thistle, milkweed, all have their particular Other species haunt the flat white friends. clusters of the elder. Some are less delicate in their tastes, and are found collecting sweets from decayed fruit, and still others, though you would not expect it from creatures so gay and dainty, hover about decomposed animal matter, gathering something, certainly not "sweets."

Moths are mostly night-fliers, but some are abroad only in the twilight. It is common to find them sleeping in the daytime on the under side of leaves, on tree-trunks, etc. Most of them

have a knack of choosing a surface coloured so much like themselves that only a sharp eye will detect them. One day in summer I was standing in a chair under a large, square porch, adjusting a screen which had blown loose from its fastenings. The house had once been painted, when or of what colour nobody recollects; but it is now a soft, even grey. Right under my hand, as I lifted the screen to its place, was a large moth with soft grey wings, shaded precisely like the clapboards. He was in plain sight, with his wings spread out flat, as a moth's wings always are when at rest, but I never should have seen him but for accidentally putting my hand almost on him. A few days afterwards I found another moth of the same kind on the trunk of an apple-tree, his wings looking exactly like a patch of the mottled grey bark.

This similarity of colour between the insect and the surface on which it lies, constitutes its protection from its enemies. The insects, therefore, are said to have protective colouring.

The twilight-flying moths are called hawkmoths on account of their long, narrow wings and strong flight. They are also known as sphinges or sphinxes, because the larvæ when at rest have a queer habit of rearing up in front and remaining a long time in that attitude, a whimsical reminder of the Sphinx in Egypt. A popular name for them is humming-bird moths, because in the twilight they are often mistaken for these birds. They are about the same size, and as they poise over a flower to extract its honey, their wings vibrate with a whirring sound. They like especially the honey of syringa, lilac, phlox, and other garden flowers.

The night-flying moths are the more numerous and are easily collected. On warm, cloudy, and even rainy nights they are abroad in great numbers. You may invite them into your own house by setting a bright light near an open window, though you will probably have also some visitors whom you do not invite,-mosquitoes and others. Or you may put a lantern outdoors on a sheet spread under a tree, and you will always attract specimens of some kind. Wind a tree or post with strips of cloth daubed with molasses flavoured with rum, and the moths will show their lack of temperance principles by coming to the feast. Instead of molasses you can use coarse brown sugar, but refined sugar has too little odour to attract the moths. Make your mixture so stiff that it will not run down and go to waste. It

can be applied directly to the tree or fence if you prefer. Lay it on with a brush or swab, two inches wide and several inches long. The insects will not visit your bait if there are attractive blossoms near, so do not choose trees with sweet flowers on or close by them.

You may take your lantern (a dark lantern is best for this) and search among the willow catkins in the springtime. If you live near an electric light, visit that on a warm evening, and you will be surprised at the number and variety of insects that circle around it. If a young female moth of the Saturni'ida, or Giant Silkworm family, be hung out-of-doors in a cage of netting, she will attract many of her friends, some of whom you can add to your collection. The under side of bridges is often a resort for moths. One collector told me that whenever he wanted a specimen of a certain sphinge, he went to a bridge near by and got it, and that in the proper season these moths might generally be taken there by the half-dozen.

I have said a good deal about moths and butterflies, because the fancy of a young collector is generally attracted to them first, not only on account of their lovely colours and shapes, and the wonderful metamorphoses they undergo, but also because of their numbers and the ease with which they may be found and captured. But beetles are an extremely interesting order, very easy to collect, and requiring little skill or time to mount. For this reason they are even better to begin with than the *Lepidop'tera*. Many of them, too, are very graceful and handsome. They are found nearly everywhere; in damp places and in dry ones, in rotten wood, about decaying animals and vegetables, in the ground, under stones and rubbish, on the water and in the water, on the hot, sandy plain, and the hard-trodden footpath.

The Hymenop'tera, to which ants and bees belong, is one of the most interesting orders in the insect world, many of its members possessing an instinct which seems almost like human intelligence. Men have devoted years of study to this order alone, and yet the most common species are far from being fully understood.

The dragon-flies, *Odona'ta*, though a small order, are very attractive. Their haunts are sunny fields and watersides.

You will obtain a good many small insects, and often large ones, by beating the bushes and tall grass and routing out everything that has taken shelter there. Nets are made for this purpose, but you can do very well without them. Also, sweep the vegetation on the sides and bottom of pools and streams, using a dip-net of strong, fine netting.

Deep, shady woods and wide, open plains are the least promising places for specimens, nor will you find many in pasture lands. Perhaps the cattle disturb them too much, more likely the close cropping of the grass destroys their hiding-places; but at any rate they are not there.

Some insects are shy and alert, and match their skill in flight against yours in pursuit with remarkable success; others crawl over you or fly into your face with a freedom which not only renders them an easy prey, but makes you more than willing to catch them as a punishment for undue familiarity. As with other things, however, the ones most readily secured are not always the most desirable. If you wish the best, you must hunt for it; hunt diligently, hunt always, with zeal, with patience, with perseverance. Have one eye out for specimens wherever you go and whatever vou are doing. I have heard it told of my own father that when taking walks with my mother during their wedding journey, he could not

resist the impulse to turn every stone with his foot, and to poke his cane into every bunch of grass. I knew also a half-grown boy who was riding one day with a girl-friend along a country road, when he saw a strange snake glide across the track. Instantly oblivious to considerations of gallantry, he flung the reins on the horse's back, leaped out, and grabbed the snake's tail just as its owner was slipping under the fence. Luckily the horse knew his driver's ways and no harm resulted. This boy afterward made his mark in Natural Science.

When you walk, or play, or work at out-door tasks, you will find prizes in all sorts of unlikely places, and generally, judging from experience, at times when you are farthest from your net and cyanide bottle. You can not always have them with you, but a few disappointments of this kind will teach you to slip the bottle into your pocket on starting out, whenever it is possible. The collecting-box, if you own one, is a good thing to carry, since it has a shoulder-strap, and contains a place for one or two cyanide bottles, and a peat-lined and papered compartment for pinned specimens.

The real scientific spirit never sleeps. It

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must often be made secondary to other interests, but it is ready to come to the front at the least encouragement. It does not wear everybody out with the energy of its operations one day, and sink into indifference or distaste the next. It does not fill the house with specimens in all stages, and leave them to be taken care of by somebody else or by nobody. It does not take the life of even an insect wantonly.

A common and an excellent way to obtain perfect specimens is to collect cocoons and pupæ, which are found either in Cocoons and summer or in winter, and in almost Pupæ. every kind of surroundings. over stones, boards, and heaps of trash. in the garden where the tomatoes and potatoes grew last year. Follow the plough and harrow, if you are so fortunate as to live in the country. Hunt in the mould of decaying logs and stumps, and pull off the loose bark of trees. Look in cracks between boards, in the angles of sheds and barns, under the edge of roofs and clapboards and shingles. Dig over the chipyard, and search around piles of boards and logs, or of old sleepers along the railroad. As you go about in the fall and winter, look

up at the leafless trees against the sky, and if you see a queer protuberance on a branch, or a spindle-shaped swelling, or a dead leaf rolled up and clinging to a twig, get at it if you can, and investigate it. In a word, keep your eyes open.

When you find a cocoon or pupa carry it home and put it where it will have as nearly as possible the conditions in which you found it. If it was in an open place with light and air, give it a box with perferated sides and glass or wire-net cover. If it was buried in the ground, cover it with fresh earth in a dark place. You need take no pains to keep pupæ warm, for nature has fitted them to withstand cold. Besides, if they are kept in a warm room, they will develop faster than is natural and will come out in the spring before there is anything for them to eat; moreover, a warm room is apt to be a dry one, and if the pupæ do not have sufficient moisture they will not develop properly, perhaps not at all.

The pupæ will lie without visible change, some for days, some for weeks, some all winter or even longer. The pupa of one species of cica'da lies in the ground seventeen years. If you poke your pupæ they will sometimes squirm a little, but generally they show no sign

of life. You must give them plenty of box room, because they are quite sure to come out when you are not expecting it, and if they are cramped at all for space they will dry before they have fully unfolded, and the insect is spoiled either for a collection or for freedom. You must also keep their boxes covered, or, as I have just said, they will *come* out and *go* out, leaving you no richer but somewhat wiser. With proper care, however, you will obtain finer specimens in this way than in any other.

This is a very fascinating way of studying entomology. You can find larvæ of some kind from early spring to late fall. Even Collecting in winter the displacement of a stone Larvæ. or board, or the raking over of a rubbish heap in a sunny spot, will frequently bring to light a larva, usually one of the sort called by children "woolly bears," having a reddishbrown band round the middle of a furry, black The proper name of the moth is the Isabella Tiger-moth. The caterpillar hides in some sheltered spot during the winter, and in the spring breaks his long fast by a few good meals, and then goes to sleep as a pupa, or chrysalid, weaving his bedclothes out of his own hair.

One way of finding large caterpillars is by looking for their droppings on the bare ground under certain trees; elm, maple, plum, and others. Notice also the outer small branches, and if you see one more or less bare of leaves, the chances are that some caterpillar is at work upon it.

Our forest trees, our field flowers, our garden plants, our growing grain, the grass in the meadows, the weeds by the wayside, are nearly all the food of some species of larvæ. You will find them on their chosen tree or plant, and will know how to feed them; you will also find them crawling on the ground, or on a fence or building, and you will be puzzled to know their proper food. They must have it, however, or they will soon die, for a caterpillar has a mind of his own on the question of diet. What he likes he will eat greedily, but what he does not like he will not touch. He will die first. So if you are not able soon to supply your captive's wants, turn him loose. you can watch him until his instinct leads him to the food he desires, but if not you should let him go rather than take his life to no pur-Larvæ do not all eat leaves; some prefer blossoms, others seeds, stems, or roots. Many live on fungi. Some are carnivorous.

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Still others feed on decaying animal substances, but you will prefer to let these earn their own living as larvæ, and to collect only the ima'go, or perfect insect.

Caterpillars should be kept in boxes, not too small, with the sides perforated with many holes, and a piece of glass or wire net over the top. For perforating I use a shoemaker's punch, but it is no better than a nail or a knifeblade except that it makes neater holes. Keep the boxes out of the sun, and choose a room where the temperature varies as little as possi-Supply your captives with fresh food every day, sometimes twice a day, and at the same time clean out all the debris. They are dainty creatures and will not thrive in filth. Do not handle them often, and be gentle in your treatment of them. They have no wish nor power to harm you, as a rule (though a few are armed with venomous spines or hairs), and they do better if left as much as possible to their own will. As soon as they show signs of failing appetite, and begin to crawl restlessly about their box, supply them with a few twigs, or a piece of bark, or the proper depth of damp (not wet), clean earth, and they will attend to the rest themselves. Sometimes they will not eat at all after being taken, but will transform at once; sometimes they will wait only a few days; and occasionally a species will feed with unabated appetite all summer and far into the winter, keeping you at your wit's end for supplies.

Raising insects from larvæ is even a better way than collecting them, because it not only gives you perfect specimens, but it is an educational process based on the modern principle of "learning Larvæ from Eggs. by doing." When you have watched these little life-histories from beginning to end, you will have learned much of the marvellous skill and unfailing instinct of the insect world.

To raise larvæ you must collect the eggs. These are not easily found until your eye is somewhat trained to it. They are always laid in or near the substance which will be the nourishment for the larvæ when hatched, though this is not often the same as the food of their parents. The eggs are fastened singly, or in clusters or patches, to twigs, bark, leaves, or stones, sometimes varnished over, sometimes wrapped in silk or hair from the female insect's body; sometimes they are buried in the ground; sometimes they are laid under water; sometimes they are deposited on the bodies of other

insects whose life will by and by be destroyed by their formidable guests.

The eggs of insects are not injured by cold, rarely by wet. Some species hatch in a few days or weeks, and these are deposited in less carefully sheltered spots, and often not protected by any covering. Others do not hatch for months, and these are the ones that are glued so fast to bark or stones, and covered with a varnish that neither cold nor wet af-Insect eggs are always interesting and often very beautiful under a microscope. Some are shaped much like a hen's egg, smooth and oval; some are globular; some are round and flat, like a disk; some are ribbed or pitted. All eggs are more or less netted on the surface, and most of them have ribs, either straight or zigzag, running from top to bottom. under surface, by which the egg is attached, is flat. Some eggs are almost transparent, and others are adorned with lovely tints. In size they are seldom larger than the head of a pin. Every egg is traversed by tiny canals, not to be seen except under a powerful microscope. The canals terminate at the top of the egg in a rosette of cells, each cell being the opening of a canal.

With eggs you must follow the same rule as

with larvæ,—give them their natural conditions of heat, light, and moisture.

Do not fail to make notes of your work and its results, and learn to illustrate by drawing whenever possible. No matter how poor your drawing is, if it means something to you it will help you to remember about your specimens.

In regard to each specimen, note when and where it was found, and what it was doing, if it was doing anything. Draw or describe its shape, colour, and markings. Tell what you know of its habits. Your notes need not be profuse, but they must be true. Do not guess, but observe carefully and write down the results exactly. The habit of close and accurate observation will always be of great value to you, and if you learn to state facts precisely as they are, and to draw sensible conclusions from them, you will do what a vast number of persons can not do. Be sure to make your notes before you forget. There must be no guesswork or the value of your statements is gone.

Record the time it takes eggs to hatch and larvæ to transform. Note the food preferred by each specimen, and whether he eats more than one kind. A number of "woolly bears" which I had in captivity one summer would eat clover, plantain, and various common weeds, not seeming to have much choice, but when I gave them a spray of trumpet-creeper they left everything else for that. At last they made a brave attempt to eat one another, and succeeded so well that finally only two remained out of six, and one of those had woven a cocoon and put himself out of harm's way. Many other insects, both larval and perfect, have a varied appetite, and if one viand is not within reach another generally is. On the other hand, there are those whose bill of fare contains but one article, and unless they have that they will starve.

If you try any experiments, make notes of them and their results; and if you make mistakes, a record of these may be useful in the future to you or to someone else. To follow my own advice, I might tell you of two of my own mistakes, made in my early collecting days.

I gathered in the fall a large cocoon which I kept all winter on a shelf in the warm diningroom. One day in early spring I found the cocoon empty, and a beautiful creature with yellowish-brown wings, marked in rings and lines of pink, yellow, and black, clinging to a begonia in the window. He was not quite perfect, so I decided not to keep him; but I could not induce him to go free. I gave him every opportunity of open windows and bright sunlight, but he never stirred, except that sometimes in the morning I would find him in a different place on the plants. He ate nothing, and grew, I fancied, thin and weak, until I was so distressed that I was inclined to kill him to save his life. But one day it dawned upon me that he was a moth, a nightflier, and I had been trying to make him fly in the sunlight! That evening I carried him and his plant to the open window of an unlighted room, and before my own eyes were fairly adjusted to the change, the noiseless wings had borne him out into the darkness and I never saw him again. I have often thought of him, however, and wished I knew his opinion of me.

At another time I had in a box a caterpillar called a tomato-worm, which showed by its actions that it was ready to transform. It stopped eating and was very restless, so I gave it some twigs and leaves that it might suit itself as to material and location. But it would not be suited,—it wandered all day, and as far

as I could judge, all night, about its little prison, and worried me so that I was tempted to let it go free. Then it stopped crawling and became as quiet as it had been restless, and I was sure it was going to die—till all at once I remembered. I rushed to the garden, filled the poor creature's box half full of soil, and within fifteen minutes it had buried itself deep in the cool, damp earth, out of sight of the stupid human giant who knew so little about caterpillars and their needs.

I had to learn many lessons by experience, for at that time no attention was paid to nature-study in schools, and there were none of the charming nature-books for children which are so accessible now. I did know, however, that moths do not fly by day, and that certain caterpillars bury themselves in the earth to transform, and I never forgot it again.

Make especially careful observations of the structure and habits, not only of your own specimens but of insects as you see them in their own homes. A great deal remains to be done in the way of original work of this kind, and aside from the honour of adding to the world's scientific knowledge, you ought to gain from it for yourself health and pleasure, and loving reverence for nature.

A perfect insect is composed of three distinct sections,—the head, the thorax, and the abdomen. The head bears the eyes, Insect the mouth, and the antennæ. To the Anatomy thorax are attached the legs, and the wings if there are any. The abdomen has no

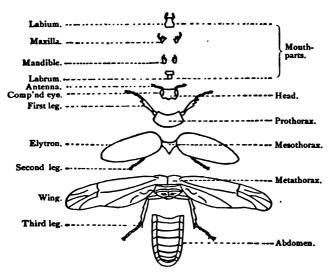


FIG. 5. PARTS OF AN INSECT, SEPARATED (BEETLE).

appendages which are common to all insects, but one order has what are called "rudimentary" legs, that look as if they were left half finished; others have jointed hairs at the tip of the abdomen; others have little tubes which give out a sweet, glistening fluid known as "honeydew." Many female insects have a sting, and others an ovipositor, or egg-placer, which they use as an awl, or a gimlet, or a saw, and finally as a tunnel through which they drop the eggs to the bottom of the hole thus made. Appendages for breathing are attached to the abdomen of some larvæ.

The eyes of adult insects are either simple or compound, often both. If they have but one kind it is generally compound. A simple eye is a single eye; it is called an ocellus. Insects have from one to four simple eyes, but most of them have three set close together on the top or front of the head, between the compound eyes. The latter are on either side of the head, and often very prominent, so that the owner can see behind him as well as in front of him, as we can look in both directions along the street when we stand in a bay-window. This is fortunate, for an insect cannot turn his eyes as we can,—they are immovable in his head.

A compound eye under a microscope looks like a section of honey-comb, being made of many small eyes called ocelli, which are sixsided, and are so arranged that only the outer end of each is visible. There are from fifty to many thousand ocelli in the compound eyes of different insects.

The antennæ are the jointed appendages which many people call "feelers," because insects sometimes appear to be feeling their way as a blind man feels his with a cane. The antennæ are thought by some authors to answer the purpose of ears, of which insects are apparently otherwise destitute; and some suppose them to take

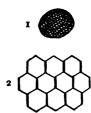


FIG. 6.

I. COMPOUND EYE OF
FLM, MUCH ENLARGED. 2. PORTION OF SAME,
HIGHLY MAGNIFIED.

the place of noses. It would seem a queer thing to hear and smell with the same organ, and the highest authorities do not uphold

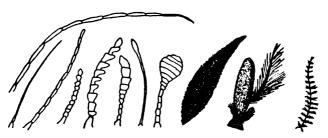


FIG. 7. VARIOUS FORMS OF ANTENNÆ.

this theory. But at any rate all insects have antennæ, and make use of them constantly. Those of ants are extraordinarily sensitive, and they appear to do a good deal of talking with them. Antennæ are always borne on the head, between or in front of the eyes. They are of many different forms. Some are like bristles, tapering to a point, and either naked or clothed with hairs; some like a thread, tapering little or none; some like a string of rudely cut beads; some a little like a saw-blade, or like the jagged, irregular edge of a fern-frond; some like a club, widening toward the end; some with knobs at the ends; and still others like a feather, or a comb. All antennæ are jointed, usually with eleven joints.

The mouths of insects vary even more than the antennæ, because of the different ways in



FIG. 8. MOUTH-PARTS OF INSECTS (AFTER MORSE).
1. Bug. 2. Fly. 3. Moth. 4. Beetle.

which insects obtain their food. Butterflies and moths have a long tube for sucking honey from flowers and fruits, and carry it in a coil like a watch-spring when not in use. Flies also have a mouth formed for sucking: a short,

fleshy proboscis, which is bent back under the body when not needed. Mosquitoes, as you may have noticed, have a mouth like a drill used for driving wells—it not only bores the hole, but being hollow it furnishes a passage for the blood. Many other insects have the same kind of mouth. Bugs are sucking insects, but, like mosquitoes and others of the order Dip'tera, or flies, they are able to pierce the hole through which they suck their food. Hymenop'tera, bees, wasps, etc., seem better fitted for getting a living than other orders, for they can not only bite (and bite hard) but can also suck and lap liquid food.

Biting insects, of which Orthop'tera and Coleop'tera are the best-known orders, have, like the rest of us, an upper and under lip, but between the lips they have two pairs of jaws, opening sidewise, which we should consider very inconvenient. The upper lip is called the labrum, the under the labium; the upper jaws are called mandibles, the under, maxillæ. The mandibles are for biting, the maxillæ are for gathering liquid food. There is also a sort of tongue attached, like ours, to the lower part of the mouth-cavity, and still another to the top—as if we had a second tongue growing out of the roof of our mouth; which would be

even harder to manage than two pairs of jaws. Appendages called maxillary palpi are attached to the maxillæ, and others, called labial palpi, to the labium, or under lip. A palpus is a feeler. There is a second appendage to the maxillæ of some biting insects called the ga'lea. The mouth-parts of insects are somewhat hard or horny, not fleshy as in higher animals.

All these parts and appendages, as well as the body of the insect, are made up of more or less regular rings or bands, called scle'rites. These rings are not always easily distinguished, but you can see them plainly in most larvæ, and generally in the abdomen of the adult insect. Between the sclerites there is a narrow space, sometimes only a line, of flexible surface, which allows free motion of the body and limbs, as the armour of ancient heroes was made in links or overlapping scales for the same It has not been fully determined how many rings make up the head of an insect, for they are so united as to obliterate the divisions. The thorax is composed of three rings, and the abdomen of from three to nine. The rings of the thorax are named, beginning next to the head, pro'thorax, mes'othorax, met'athorax.

The thorax bears three pairs of legs, one pair on each ring, for all true insects have six

legs. Each leg is made of five parts, coxa, trochan'ter, fe'mur, tib'ia, tarsus. If you have studied physiology the last three names will be familiar to you. The tarsus commonly has five little segments of its own, and on the last, one or two claws. Often, also, the segments of the

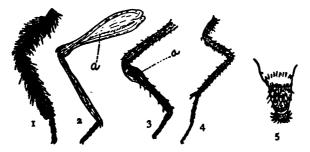


FIG. 9. LEGS OF INSECTS.

Bee. 2. Grasshopper. 2 a. Row of spines, used as a fiddle.
 Katydid. 3 a. Organ supposed by some authorities to be an ear (after Comstock). 4 Gnat. 5. Pro-leg of caterpillar, tipped with hooks for clinging (after Morse).

tarsus have on the under side cushions or concave plates, by means of which the insect walks on the ceiling and similar surfaces. He can expel the air from the concave plate by pressing it against the ceiling, much as you suck the air out of a thimble and make it cling to your tongue. The first pair of legs is sometimes fitted for seizing prey.

Most insects have two pairs of wings, but some have one pair and a few have none. When there are two pairs they are attached to the second and third rings of the thorax; when there is but one pair it is attached to either the second or the third ring. The prothorax never bears wings. Some insects, as the beetles, have instead of the first pair of wings a pair of stiff covers called el'ytra, under which the real wings are folded when not in flight. The May-beetle, miscalled the June-bug, is a good example, because we all know him. He is notably careless about his wings, and generally leaves them sticking out from under the covers, but most beetles fold their wings neatly out of sight when not in use. Some beetles have the elytra but no wings at all; these are running In four-winged insects the front wings . are generally the larger. The two-winged insects have, in place of the hind wings, two thread-like appendages with knobs on the ends. Some authorities say that these help to balance the insect in the air, but probably the insect himself is the only one who knows positively what they are for. They are called halte'res.

The wings of grasshoppers lie straight along the back when at rest. Those of butterflies are held upright and display the under side, which is often more beautiful than the upper; those of moths, on the other hand, lie flat and conceal the under side, which is seldom gaily coloured. The four wings of a dragon-fly always stand straight out from the body, whether at rest or in flight. In the *Hymenoptera* the two wings on each side are hooked together, and the females of the ant family pull off their own wings when ready to lay their eggs, knowing that they will need to fly no more.

The veins or nerves of an insect's wing constitute a framework which supports and stiffens the membrane, like the frame of a kite, except that the kite-frame is made of a material entirely different from the body, while the wingframe is simply the membrane itself, thickened and stiffened. These veins run in a general way like the sticks of a fan, starting from the point where the wing joins the body, and spreading out either way, making the wing somewhat triangular in outline. But the angles and curves and branches are so different in different families and orders that the veining, or venation, of the wings is one of the principal points in classifying insects. It is too difficult a study for beginners, but when you are ready to take it up you will find it, with nearly everything else you want, in Comstock's Manual for the Study of Insects. It is enough for you to know now that the spaces between the veins

are called cells; if they reach to the edge of the wing they are called open cells, if the veins enclose them they are closed cells. The front margin of each wing is the costal margin, and the vein that stiffens it is the costa; the other margins are called outer and inner. These are not bordered by veins, but the ones nearest the inner margin, one, two, or three in number, are called the anal veins.

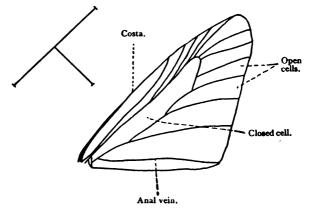


FIG. 10. VENATION OF ONE OF THE LEPIDOPTERA.

The internal possessions of an insect consist principally of a heart, an alimentary canal, a nervous system, organs for breathing, blood, fat, muscles, etc. The heart is a long, straight tube open at each end. The alimentary canal, a crooked and still longer tube, extends the whole length

of the body, and is divided into parts named much like those of higher animals. The blood, which is colourless or slightly greenish, fills all the body-space not otherwise occupied, as if the organs had been put in place first and the blood poured in to fill the cracks. It is pumped by the heart into the head, whence it flows back into every part of the body and appendages, and again to the heart, having a regular circulation but not being confined in veins, nor in any blood-vessels except the one called the heart.

The muscles are numerous, and very strong and rapid in their action.

The respiratory system consists of a set of air-tubes of different sizes, called tra'cheæ, which extend to all parts of the body, and connect with the outer air by openings along the sides of the thorax and abdomen, called spir'acles. Sometimes there is a sieve or other contrivance to keep the dirt out, but not always. The spiracles are found on some but never on all of the three segments of the thorax, and the first eight of the abdomen. No segment bears more than one pair, one on each side. The spiracles are often plainly visible to the eye, and are sometimes made very conspicuous by a ring of colour about each one.

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Aquatic insects have extremely curious ways of keeping themselves supplied with air. Some carry it in a little cavity under their wings, directly in contact with the spiracles, coming to the surface when they need a fresh supply. Others have the spiracles extended into long tubes reaching to the surface of the water. Most aquatic insects breathe through tracheal gills, attached generally to the abdomen, sometimes to the thorax. These are appendages of various forms, containing an abundant supply of air-tubes, the walls of which are so thin that the oxygen in the water passes readily through them and purifies the air in the tubes. With one exception, it is only in the larval state that insects possess these gills. Adult insects do not have them.

You see, an insect is quite a complicated affair. I might give you more facts, and more technical terms, but you have enough to enable you to study intelligently, and there are other books, far more scientific and comprehensive than this, which you can make use of as you need them.

All insect life begins with the egg, and from the egg in due time hatches the larva. The young of nearly all insects are called larvæ, and it is always a safe name to use in speaking of them; but to distinguish them more definitely, the larvæ of moths and butterflies are called caterpillars; those of beetles are called grubs, with the special name of borers if they are found in the trunks or limbs of trees; while the larvæ of the order Diptera, or two-winged flies, are called maggots. The name nymph is given to the young of certain insects that do not form a pupa, but these you will find described later in this chapter. With the exception of nymphs, all insect young are called larvæ.

The name worm, applied to caterpillars, grubs, and maggots, is not correct, though it is used by a great many people for almost anything that crawls. Worms never have legs; larvæ, except maggots, always have legs. Worms are not insects. They are born and they die worms, never changing to any other form. Larvæ always come from the egg, and sooner or later change to winged creatures. The earth-, mud-, fish-, or angle-worm is our only common worm found on land; hair-snakes and leeches, living in ponds and streams of fresh water, are also true worms, as well as some occurring inside the bodies of men and animals. Except these there are

few worms outside of the ocean. So do not allow yourself to fall into the common error of calling everything that crawls a worm, although the name is applied, even in scientific books, to various caterpillars, as cut-worm, currant-worm, etc. The thousand-legged worm, so called, is not a worm, neither is it an insect, although it is related to the insects. Its name is well given, some species having eight hundred legs.

The mouth-parts of larvæ, like those of adult insects, generally consist of two so-called lips, and two pairs of jaws; but they are so small that "in the largest of our butterfly caterpillars, they would not together be larger than a pin's head" (Scudder).

The eyes of caterpillars are six tiny knobs, five of them lying in a crescent with its open side toward the sixth, which is quite by itself, farther back on the head.

The antennæ are very short and small, and lie below and in front of the eyes.

Some larvæ have naked skins, others are covered with soft, short hairs, others with bristles or spines. Some are decorated with fleshy horns, and others with little knobs called tubercles. The hairs, bristles, and spines are either scattered regularly over the surface of

the body, or in bunches, rows, or rings. Caterpillars are never quite naked.

Certain larvæ have an apparatus for spinning the silk which they use to make their cocoons, or to fasten themselves securely when about to transform to pupæ. Many of them, also, in their early days, spin a silky path for themselves as they move about, which makes their foothold more secure. When you see a caterpillar wagging his head and shoulders from side to side, you may know that he is spinning silk for some purpose of his own. In the middle of the caterpillar's lower lip, or labium, there is a small opening, the end of a tube which connects with two glands or bags in the creature's body. These glands contain a sticky fluid which hardens into silk instantly, when exposed to the air. This silk is fine and tough; brown or yellowish-white in colour.

The larvæ of one butterfly family, the swallow-tails, are characterised by a little crosswise slit on the back just behind the head. It is not noticeable at all until the caterpillar is disturbed, when it instantly thrusts out through the slit a pair of fleshy horns shaped like a V, which give out a very disagreeable odour. These horns are called osmateria, and are probably the creature's weapon of defence. They are always bright-coloured. The swallow-tails are the only common butterfly larvæ having osmateria.

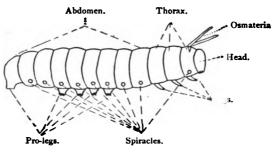


FIG. II. PARTS OF A LARVA.

Larvæ have more fat in their bodies than adult insects, and the alimentary canal, which in the adult has folds and turns, in the larvæ is nearly straight.

While in the larval state the insect lives only to eat. Its food is the plant on which the egg was laid, though it usually eats first the egg-shell it has just left. Caterpillars whose food is leaves eat along the edge, as a rule, bestriding it with their double row of legs, and munching greedily and audibly. They seldom eat the midvein, and I wonder if they know the stability of their dinner-table depends on it. If so, they are wiser than a man I knew who sawed off from an apple tree the limb on which he stood. They do one thing, however, that

seems foolish to us. They sometimes make a cozy house from a green leaf, and when snugly settled within it proceed to eat it up, leaving themselves without a roof over their heads until they can make another.

All growth takes place in the larval state. As the creature grows it becomes too large for its skin, which, though soft and elastic at first, has hardened so that it will stretch no farther. The skin then bursts, usually along the back, sometimes with an audible crack, and the larva

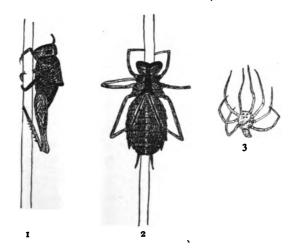


FIG. 12. EXUVIÆ. 1. GRASSHOPPER. 2. NYMPH OF DRAGON-FLY. 3. SPIDER (AFTER MORSE).

wriggles and crawls out, clad in a new skin which has been forming under the old one.

This new skin is soft like the first, but in its turn hardens, bursts, and is left for a new one. This process is called moulting, and takes place from four to twenty times in different species. You will sometimes find the cast skin of an insect, as you do that of a snake. Those of dragon-flies are quite common, clinging to bulrushes in the water's edge, and I have found fine skins of locusts and cicadas. These skins are called exuviæ.

The last moulting brings to view the next form of the insect, the pupa. The pupa of a pupe.

Butterfly is also called a chrysalis. It is a lifeless-looking object, generally with a brown, horny covering on which may often be traced the outline of wings, legs,

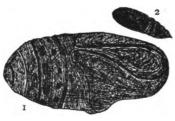


FIG. 13. PUPÆ.

1. Cecropia Moth. 2. Currant Span-worm.

Samia cecropia. Diastictis ribearia.

and antennæ; but chrysalids are sometimes very beautiful in colour and markings. One common caterpillar, the Monarch, found on milkweed, changes to a lovely pale-green

chrysalis with golden dots, and hangs it by a short, tiny silken cord to the under side of some

object. Others attach the lower end of the chrysalis to a vertical or horizontal surface, and hold it in place by a narrow silk band passing around the middle of the chrysalis and fastened at each end to the surface. In doing this, the caterpillar first spins a little silky tuft, fastens his hind feet in it, makes the loop as long and as strong as he wishes it, and then puts his head under and wriggles his body through until it holds him firmly. Here he hangs motionless, secured by his tail and his belt, till his caterpillar skin bursts and drops, leaving the pupa still suspended by the girdle. Hence these are called girdle or belted caterpillars. The caterpillars of moths, and some

other larvæ, spin or weave a case of silk or hair about themselves, and change to a pupa within its protection. FIG. 14.
Weather has no effect

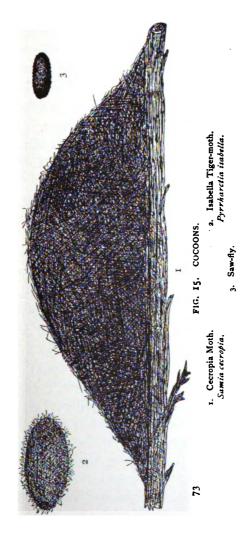
FIG. 14. CHRYSALIS OF GIRDLE CATERPILLAR.

upon these cases, which are called cocoons, and birds and other enemies of insects will not touch them. Some larvæ roll up a leaf and spin inside of it, or draw a number of leaves together. The caddice-worms, the larvæ of the caddice-flies (not worms, however), make cases of sticks, straws, grains of sand, bits of moss or leaves,

which they line with white silk, and carry about with them as they crawl over the bottom of ponds and streams, or up and down the stems of water plants. Other larvæ find shelter on the ground under grass and leaves, or in one of the various places suggested under the heading Cocoons and Pupæ.

The pupa has no power of motion beyond squirming when disturbed, and many cannot do even this. Pupæ, of course, do not eat. They are, however, changing inside their shell into something very different from the larvæ that went into retirement, and finally, after periods varying greatly in different species, they transform for the last time, and appear as the ima'go, or perfect insect.

The imago crawls out of its ruined shell, a moist, weak, trembling, crumpled thing, which soon dries, grows stiff and strong, and goes on to the completion of its life-work. Growth and change are ended now. Small insects never become large ones; adult insects never moult. They eat but little, some nothing at all, and they generally live but a short time after laying their eggs. These they deposit singly, or in clusters or rows, or in a ring surrounding a twig, or (as in at least



## Insect Friends and Foes

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one species, known as the Hop-merchant, Polygo'nia com'ma) in a pendent chain of from three to nine eggs. Others are laid on the ground, or on grass blades. Once laid in a carefully chosen spot, the insect generally concerns herself no more about them, although some, as in certain families of Hymenoptera, devote themselves faithfully to their eggs and young.

The transformations of insects are called metamorphoses, and they are marvellous indeed.

Metamorphoses.

I have spent many hours, sometimes whole nights, watching larvæ moult, or prepare for the change to pupæ.

The moulting is very interesting, and the skill and patience with which the creature struggles with its outgrown skin, cannot fail to excite admiration and sympathy, and often amusement. Sometimes, too, the effort ends in a tragedy, the horned caterpillars, especially, often dying in the process of moulting.

All insects that pass through these four stages, the egg, the larva, the pupa, and the imago, are said to have a complete metamorphosis. The larvæ are entirely different in form from the adults. They are, however, made of rings, and they have three pairs of

horny, jointed legs, each ending in a little claw, on the three rings next back of the head, which develop into the three pairs possessed by the perfect insect. Caterpillars have also other legs, not jointed, whose purpose is to help their owner to cling, for you can easily see that a creature with a long, soft body must have support for its hinder part. These legs are called pro-legs. They are fleshy, and can be stretched or contracted to suit the situation, and have instead of horny

claws a set of curved, elastic hooks, just the thing for clinging to the meshes of caterpillar-silk, or the tiny crevices over which their owner travels. The pro-legs are shed with the skin at the last moulting. They number from two to ten.

There are many insects whose metamorphosis is incomplete. These have no larval nor pupa stage, but are

FIG. 10.

NYMPH OF DAMSEL-FLY.

Agrion; a, tracheal gills.

hatched from the egg almost the same in form as the adult insect, though much smaller and

without wings. They moult several times before the wings appear at all, and both wings and body grow until the insect has attained its full size. From the time the insect leaves the egg until it is fully grown, it is called a nymph. For this class of insects, then, there are but three stages,—the egg, the nymph, and the imago.

There is one order, Thysanu'ra, supposed to be the lowest of insect orders, which has no metamorphosis at all. The young when hatched are precisely like the adults, except for size; and they grow, as the higher animals grow, without special change of form.

Your collection will be a source of far greater pleasure and profit if you are able to name the specimens, or at least to determine the order, if not the family, to which they belong. The Comstock Manual (which I have followed because there is no higher authority upon insects in this country than its author) divides the Class Hexap'oda, or Insects, into nineteen orders,—Thysanu'ra, Ephemer'ida, Odona'ta, Plecop'tera, Isop'tera, Corroden'tia, Malloph'aga, Euplexop'tera, Orthop'tera, Physop'oda, Hemip'tera, Neurop'tera, Mecop'tera, Trichop'tera, Lepidop'tera, Dip'tera, Siphonap'tera, Coleop'tera, Hymenop'-

tera. No other writer gives as many, but, as Professor Comstock suggests, it is easier to learn the characteristics of nineteen clearly defined orders than of seven vaguely defined ones.

To younger readers these names may look rather formidable at first sight; but that is only because they are strange. As you gain familiarity with the different orders, you will find Lepidoptera and Coleoptera as easy to pronounce as butterflies and beetles. When you study the marvellous instincts of ants and wasps, Hymenoptera will not seem a hard word to speak. I am sure, also, that Orthoptera is not much longer than grasshopper, and Odonata is certainly shorter than devil's darning-needle, or any other silly name of that well-known insect.

Each name, too, has a meaning. Thirteen of them end in ptera, which comes from the Greek pteron, meaning a wing; and all these names are given on account of some characteristic of the wings. Physopoda are named from something curious about the feet, the Greek pous, meaning a foot. Corrodentia comes from the Latin corrodere, to gnaw, an exercise in which this order is very expert. Mallophaga is from two Greek words meaning

to eat wool. Ephemerida comes from the Greek ephemeros, lasting only a day, which is almost literally true of this order. Thysanura is named from two Greek words meaning tassel and tail, the reason for which is evident when you examine these insects. Odonata is the only order whose name does not refer to some marked characteristic; it is from the Greek word for tooth.

Of these nineteen orders the first has no metamorphosis, the next ten have an incomplete metamorphosis, and the last eight a complete metamorphosis. I have not followed this arrangement, however, but have given first the orders most likely to be collected by young entomologists, and under each order the principal families and their most common species.





## ORDER LEPIDOP'TERA

(SCALE-WINGS)

THIS order is divided into moths, butterflies, and skippers. It includes six thousand species in America north of Mexico, arranged in sixty families. Of these, fifty-four families are moths, four are butterflies, and two are skippers.

Lepidoptera have four membranous wings, and their mouth consists of a long tube for sucking honey, sometimes with tiny spines at the tip for piercing the skin of fruit. The tube is coiled up when not in use. Lepidoptera are covered with overlapping scales which give them colour and markings, and help to strengthen the body and appendages. The scales are so fine that to the naked eye they look like dust. The larvæ are called caterpillars. These have on the thorax six jointed, claw-tipped legs which remain till the insect is full-grown. They have also from two to ten

pro-legs on the abdomen, which are fleshy, without joints, and can be contracted or extended at the owner's will. They are shed with the last skin.

Moths, with rare exceptions, fly by night or in the twilight; butterflies by day. Many

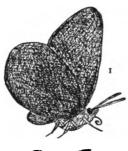




FIG. 17.

I. BUTTERFLY AT REST.

2. MOTH AT REST.

species of moths spin a cocoon for a pupa case; butterflies do not. The abdomens of moths are short and stout: those of butterflies are slender. Moths at rest hold their wings horizontally or sloping downward, never upward; butterflies always fold their wings together vertically when not in flight. Most moths have a hook and eye to hold their wings together when flying; butterflies have none.

antennæ of moths are feathery or thread-like; those of butterflies have a knob at the end.

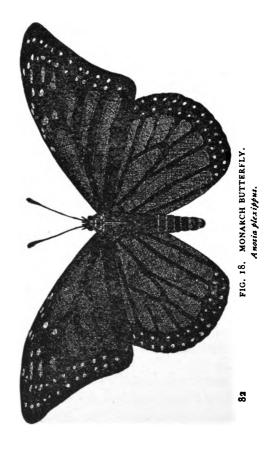
Skippers resemble in colour small butterflies. They fly by day with short, skipping flights. They frequent grassy fields and thickets, and are always found skipping about dooryards that are overgrown with barn-grass and mayweed. They fold their wings vertically when at rest, but sometimes the front wings are vertical and the hind wings horizontal. The antennæ are slender, and usually have a hook at the end. The abdomen is stout. Skippers do not spin a cocoon. The caterpillars live singly, while those of many moths live in colonies.

## FAMILY NYMPHAL'IDÆ

This is the largest butterfly family; of the butterflies you see in summer most, you may be sure, belong to this family. Its members are generally large or of medium size, though a few are small. They are called four-footed, because the fore legs are so small that they are not used in walking, but are crossed in front like a pair of idle hands. The caterpillar always spins a silky knob to which the chrysalis is hung by its tail.

This species is found nearly everywhere in the United States, and is the longest-lived of all of our butterflies. The wings

Monarch are red-brown, lighter below, with (Milkweed) black veins and borders, and a double row of white spots on the edges. The chrysalis is angular in shape, green with gold dots.



The colour fades as soon as the imago has left it, and the empty shell looks like a fragment of very thin glass. The larvæ are found in



FIG. 19. LARVA OF MONARCH BUTTERFLY.

Anosia plexippus.

July and August, feeding on our common milkweed, but you may sometimes search an acre of the weed without finding a single caterpillar. They are ringed with black, yellow, and white, and have two pairs of black, slender, fleshy horns, one pair on the thorax and one on the abdomen. They have a disagreeable odour, and birds will not touch them. They moult three times, and their colours, which do not appear at first, brighten with each moult. The eggs are shaped like a cartridge, and have a netted surface. The colour is yellow, changing to grey. They are always laid singly on the under side of a leaf.

This is found all over Europe and North America. The fore wings have a wide notch in the outer margin. They are purple-black above, banded with orange, and have several

white spots near the apex; they are variously marked below with red, white, blue, brown, and black. The hind wings are purple-black above, having an orange border with black spots in it, and are black

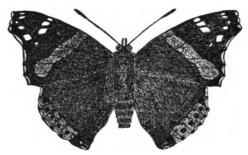


FIG. 20. RED ADMIRAL.
Vanessa atalanta.

and brown below, with a lighter border, and a yellow patch at the front edge. The marking and shading of these and of many other butter-flies are almost indescribable. The larvæ feed on nettle and hop, folding a leaf together for a nest. There are two broods in a season.

It is found throughout the United States. The wings are dark brown, almost black, above,

Painted Beauty. Painted Lady.

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blotched with orange, and the fore wings have white spots near the apex. The lower surface is a mixture of red, yellow, blue, and brown, in various shades, and there are two spots like

eyes near the outer edge of the hind wings. The larvæ feed on everlasting, the little downy plant called mouse-ear, and others of the same family.



FIG. 21. PAINTED BEAUTY.

Vanessa huntera.

This butterfly is found in the northern and northeastern States. It has black wings, bor-



FIG. 22. THE BALTIMORE, AND CATERPILLAR. by hundreds on

Emphydryas phaeton.

dered with rows of orange

The Balti-

and light yellow spots. It expands two inches or more. It lays its eggs by hundreds on the lower side

of snake-head leaves in cool swamps. When the larvæ hatch they live together in a large nest, enclosing the leaves of the plant. Their colour is orange in the middle of the body and black at the ends; the orange bearing black lines and dots. They are covered with spines with short bristles at the tips.

This is one of the larger members of a numerous group called Fritillaries. Its wings are tawny brown, with much black in Spangled spots and patches on the upper surface, and silver spots on the under side of the hind pair. These silver spots are characteristic of this genus. The larvæ

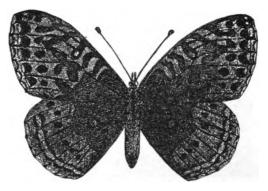


FIG. 23. GREAT SPANGLED FRITILLARY.

Argynnis cybele.

feed on violet leaves, and are found in early summer. They bear many branching spines.

It is found all over the United States. The wings are purple-brown above, with a yellow border marked with brown, and a Mourning row of light-blue spots next to the Cloak. border. The under side is covered Camberwell Beauty. with wavy lines of brown, bordered Early with yellow. The larvæ feed on the Butterfly. leaves of willow, poplar, elm, and hackberry, a relative of the elm. They are black, spiny, and covered with fine white spots.

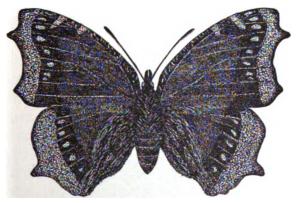


FIG. 24. MOURNING CLOAK.

Euvanessa antiopa.

A black stripe with eight red spots in it runs down the back. There are usually two broods in a season. The eggs are light yellow, and are laid, a dozen or more, in a belt around a growing shoot, always near a leaf so that the little caterpillars need not go far for their first meal. Both this butterfly and the Monarch are among the first to appear in the spring, having slept all winter in a snug crevice. I have seen a Mourning Cloak on March 11th, flying about over the snowbanks and mudholes that made up the landscape, as bright and lively as if it were June weather.

Its home is northern United States and Canada. The wings are black, shading brown,

American Tortoiseshell. Nettle Tortoise-shell. The wings are black, shading brown, and are crossed by a wide band of deep tawny yellow. There is a black spot in this band at the front edge of the fore wings, and two tawny spots on each fore wing.

The eggs are laid on the under side of nettle leaves, on which the larvæ feed. The larvæ



FIG. 25. AMERICAN TORTOISE-SHELL.

Aglais milberti.

are black above and greenish below, sprinkled with white dots and short white hairs, and bearing many branching spines. Most of

the spines are black, but some are yellowish green. The larvæ are somewhat rare.

# The Viceroy (Willow) Caterpillar 89

A careless observer would certainly take this species for a Monarch, the two are so much alike. The Viceroy's wings are the The Viceroy same tawny brown, the borders and (Willow) veins are black, and there are Caterpillar. white spots at the apex of the fore wings, and in the borders of both wings. The Viceroy is





FIG. 26. VICEROY, AND CATERPILLAR.

Basilarchia archippus.

smaller than the Monarch, however, and has a narrow black band across the hind wings. The larvæ feed on aspen, poplar, willow, cottonwood, and balm of Gilead, also on apple, plum, and one species of oak. The caterpillar makes his winter home of a willow leaf, lined and bound together with silk, and made fast to the twig by a silk band. When his house is completed he crawls in head first, and leaves the hinder part of his body to close the entrance. There are several broods each season. The Viceroy belongs to a group known as Sovereigns.

This is another member of the group of Sovereigns, found in the extreme northern States and Canada. Its wings are brownish black, crossed with a broad white band. The larvæ feed on many common trees, birch, willow, poplar,



FIG. 27. BANDED PURPLE.

Basilarchia arthemis.

hawthorn, beech, etc. Each egg is laid singly at the very tip of a leaf, on the upper side.

This species belongs to a group known as Emperors. It is confined to the western States. The costal margin of the fore wings is rounded and prolonged to a point, and the hind wings have long points or tails. The male has dark orange wings with a brown border. The female, which is

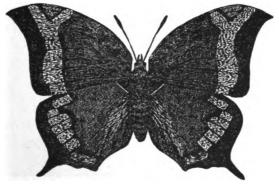
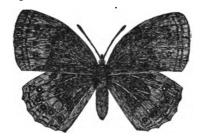


FIG. 28. GOATWEED BUTTERFLY.

Anaa andria.

larger, has a light band on both wings, inside the border, and this band divides like a Y at the costal margin of the fore wings. The larvæ live on goatweed, hence the name. They are light green, with curious light and dark markings. They make a nest-like home in a leaf, folded like a cup. The chrysalis is green and grey.

This is one of a sub-family called the Meadow-Browns, or Satyrs. It lives in the eastern States. Its wings are brown, shading lighter toward the edge, and there are four or five black "eye" spots on each. The larvæ are smaller at each



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FIG. 29. EYED BROWN.

Satyrodes eurydice.

end than in the middle, and are different from nearly all other butterfly larvæ in having the last segment of the body forked. The Satyrs are some-

times called Argus butterflies, because they have so many eyes on their wings.

This is one of a sub-family called Long-beaks,

because their palpi are prolonged into a straight beak half or quarter as long as the body. The Snout Butterfly is found in the east-



FIG. 30. SNOUT BUTTERFLY.

Hypatus bachmannii.

ern part of our country, except in the extreme north and south. It has a deep notch

in the outer margin of the fore wings; both wings are dark brown above, spotted with orange and white. The male of this species is "four-footed." The larvæ feed on hackberry leaves.

#### FAMILY LYCÆN'IDÆ

These butterflies are called gossamer-winged, from the delicate structure of the wings. They have white rings around the eyes, and generally white rings on the antennæ. The larvæ are very remarkable. They look like the slugs so often found on cabbage and other garden plants. Their legs are so short as to be invisible, and the larva moves with a gliding motion like a slug or a snail. Like a snail, also, the creatures are able to draw their heads, which are small, back nearly out of sight. They belong to the girdle caterpillars.

This family is divided into two sub-families. One of these is found mostly in the tropics, the other contains three groups known as Coppers, Blues, and Hairstreaks. The Coppers are stout-bodied, and their colours are brown or deep reddish-yellow, with a coppery shading and black marks. The Blues are slender-bodied, and the upper side of the wings is

blue. The Hairstreaks are named for the delicate stripes on the lower surface of the wings. The upper surface is usually brown. The hind wings terminate in short, slender points or tails.

The fore wings are red-orange, with black spots and a dark brown border. The hind wings are brown, with a coppery cast, and have an orange

The American Copper.

black spots in it.

This is a very com-

mon butterfly, and is found along the eastern, western,

FIG. 31. AMERICAN COPPER. *Heodes hypophlæas*.

and northern boundaries of our country. The larvæ live on sorrel—the common sorrel of our fields and roadsides.

This species has dark brown wings, with a deep yellow spot on each. The most interesting thing about it is that the larva eats a species of plant lice called Woolly Aphids, which are found in great numbers on the branches of our common alder, and the butterfly is never found except near water where the alder grows.

This little butterfly is common all over the United States. Its wings are blue above and



varieties.

grey below, and there are no tails on the hind wings. The larvæ have power to excrete honey
The Spring Azure.

FIG. 32. SPRING AZURE dew, and often have Cyaniris pseudargiolus.

This species has many a company of expe

a company of expectant ants about them. They feed on good, and some other plants,

bugbane, dogwood, and some other plants, eating only the buds and flowers.

The genus to which this butterfly belongs have little tails on the hind wings, as no other



Blues do, and at the base of each tail is an orange-yellow spot. This species is very common.

The female is

FIG. 33. TAILED BLUE. brown with a bluish cast, and the male is blue with a brown

border. You will find the larvæ on clover and other plants of that order. It is green, with three dark lengthwise lines.

This species, although not common, is found all over the eastern States, except in the extreme south. It has dark brown wings, crossed beneath by a darker band with a fine white border. Each hind wing bears a row of orange

spots, also a large blue spot near the hind angle,

The Banded Hairstreak. and has two slender tails of unequal

length. The eggs are laid in July and August on oak and hickory leaves. In the spring they hatch, transform to chrysalids



FIG. 34.

BANDED HAIRSTREAK;

UNDER SURFACE.

Theela calanus.

in June and July, and the butterflies appear a fortnight later.

The larvæ of another species, the Olive Hairstreak, feed on red cedar or savin tree; those of the Banded Elfin on pine.

### FAMILY PIER'IDÆ

The cabbage-worm and other common, slim, green caterpillars are the larvæ of this family. They are girdle caterpillars, and the chrysalids all have a point in front like the breast-bone of a chicken. The butterflies are small or medium in size, and in colour are either white, yellow, or orange, with or without black marks. They are therefore arranged in three groups, Whites, Yellows, and Orange-tips.

This is the common species with which farmers especially are so sorrowfully familiar. Its



FIG. 35.

CABBAGE BUTTERFLY; FEMALE.

Pieris rape.

Male has but one roundish spot on the

larvæ eat his cabbages and other garden plants of the same order, and are sometimes found on mignonette. They are green, with a yel-

low line along the back, and are covered with very fine hairs. The eggs are shaped like a cone. The butterflies are dirty or yellowish white above, brighter below. The fore wings are tipped with black, and there are two black spots on the fore wings of the female, and one on those of the male. The Cabbage Butterfly belongs to the Whites, and is the most abundant as well as the most injurious to vegetation.

This species belongs to the Yellows. It is found all over the eastern part of the country, and its larvæ feed on clover and related plants. They are downy, yellow-brown caterpillars, with a very pale yellow stripe along each side, and a red

line through the yellow. The butterfly has greenish-yellow wings with brown borders;



FIG. 36. CLOUDED SULPHUR; MALE. Eurymus philodice.

Fore wing of female has a wider border, and the border has a row of yellow spots.

each fore wing bears a black dot, and each hind wing an orange dot. The female has also a row of yellow spots on the brown border.

The Yellows are more numerous

than either of the other groups, and are often seen in crowds around wet spots in the road. There are many species, varying in expanse of wings from less than an inch to two and a half inches. Many feed on clover, others on cassia, for cassia and clover belong to the same botanical order.

The Orange-tips are so called because many of them have a bright spot of orange near the apex of the fore wings. Otherwise they are much like the Whites, except that their wings are mottled with green on the lower side, which shows through a little on the upper side, something like the "water-mark" on writing paper. Most of the Orange-tips are found far west, and those found in the east are not abundant.

#### FAMILY PAPILION'IDÆ

The principal sub-family is that known as Swallow-tails; large, handsome butterflies with tails on the hind wings. The larvæ are girdle caterpillars. They are nearly naked, and are characterised by osmateria. You will remember what those are: two fleshy horns pushed out through a slit on the back of the thorax, and giving out a very unpleasant odour.

This is common throughout the United States. Its wings are black, and have two rows of yellow spots across them, and another row along the edge. Black Swallow-tail. There are blue tints on the hind wings. Each hind wing has also a black spot with an orange border. The larvæ live on caraway, anise, dill, carrot, parsley, celery. They are green, with black rings and yellow spots, and the osmateria are yellow. You will find them in September, also in June, for there are two broods in a season. The chrysalis is covered with knobs and points. The eggs are globular, greenish, and laid in patches on the under side of leaves.

This is found in the eastern States south of New York. Its wings are black crossed with



FIG. 37. BLACK SWALLOW-TAIL, AND CATERPILLAR.

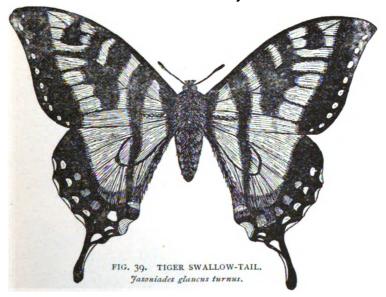
Papilio polyxenes.



FIG. 38. ZEBRA SWALLOW-TAIL. *lphiclides ajax*.

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greenish-white stripes. The tails are tipped or edged with white. The larvæ feed on zebra Swalthe leaves of the papaw tree. There low-tail. are four or five broods every season.



This is a common form of the Tiger Swallow-tail, found nearly everywhere in the United States. The upper surface of the Tiger Swalwings is bright yellow, and the wide black border contains a row of yellow dots. A black stripe crosses Turnus Butterfly. Yellow dots. A black stripe crosses low Swalboth wings from front to back, and three others cross the fore wings only. This

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butterfly haunts the wild-plum blossoms, red clover, lilac, and phlox, and collects in such crowds that there is a well established account of a collector who caught sixty at one time between his two hands! The caterpillar is green, ornamented on each side of the thorax with a queer eye-like spot, having a purple centre surrounded by three rings, black, yellow, and black. To look at him you can scarcely persuade yourself that these spots are not eyes. This caterpillar sleeps in a hammock, a silken web stretched over the hollow of a leaf. The butterfly lays her eggs, one in a place, on a birch leaf, but the larvæ eat also the leaves of the tulip tree.

These are arranged in two families, Giant Skippers and Common Skippers. The Giants expand two inches or more. There Skippers, or Hesperians. are only three species known in the United States, one found in Florida and in Colorado, one in the southern States, where its larvæ feed on the Yucca or Spanish Bayonet, and one in Arizona. Both families of skippers have the darting mode of flight, the stout bodies, and the hooked antennæ, mentioned before.

#### FAMILY HESPERI'IDÆ

These are the Common Skippers. The larvæ have a curious head and neck. head is so large and the neck so small and so long, that the caterpillar looks as if he had worn a bandage round his neck until its growth was stopped. These larvæ make a slight cocoon, as moths do and as butterflies do not.

This species is common over nearly all the United States. The wings are dark brown.

The fore wings are crossed by a line of yellowish spots, and the hind wings have a large patch of silver

Silverspotted Skipper.

on the under surface. The wings have a

FIG. 40. SILVER-SPOTTED SKIPPER, AND LARVA. family to which Epargyreus tityrus.

brown fringe, and the body is purple brown. The antennæ are larger toward the end, and bent round like a shinnystick. These antennæ are characteristic of nearly all the subthis skipper be-

longs,—nearly seventy species. The larvæ are

pale green, with orange feet, and a red head with a yellow spot on each side of it. They live on wild bean, wistaria, locust, and other plants of the same order. Mrs. Ballard, in *Moths and Butterflies*, says these larvæ eat only at night, and make round holes in the centre of the leaf instead of eating along the edge as most caterpillars do.

The name comes from the long tails on the hind wings. Like the Silver-spotted Skipper it has brown wings, but darker, with sil
Long-tailed Skipper. ver spots on the fore wings. There are green, fluffy hairs on the body. It gathers honey from the blossoms of locust and wild plum. The larvæ eat the leaves of peas, beans, cabbage, and other plants of the same orders. It is found in the eastern and southern parts of our country.

This is a common skipper with dark brown wings. On the fore wings there are nany fine white spots. The larvæ, like many others, feed on clover.

There are several species of this sub-family which are called Dusky-wings. They are brown and black, and abound in early spring among the mossy rocks and gray trunks of trees whose colours they copy so closely. As the name indicates, this little fellow is the smallest of his kind. He has reddishbrown wings with wide brown margins, which spread an inch or less.

The larvæ feed on grass. This skipper is one of the few species that do not have hooked antennæ.

#### **MOTHS**

#### FAMILY SATURNI'IDÆ

This name is given because the larvæ are found in great numbers on the Ailantus tree, which grows in and about New Ailantus York. When I was teaching some Worm. years ago in Brooklyn, my pupils brought in these cocoons till sometimes we had half a peck of them collected. It is a large caterpillar, and it encloses its cocoon in a rolled leaf, and extends the silk along the stem to the branch. It is no slight matter to tear one of these cocoons loose. The chrysalis inside is a rich dark-brown. The moth is large and handsome. Its wings are yellowgreen, each marked with a lavender crescent and various lines and bands of pink, white, and olive. It has soft white hairs on the abdomen. Its antennæ are like plumes. The

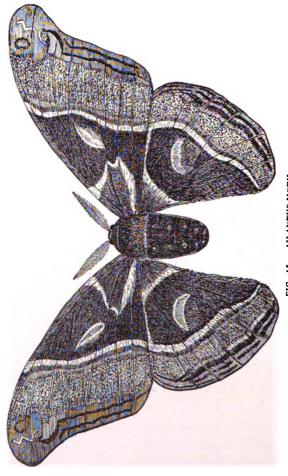


FIG. 41. AILANTUS MOTH.
Philosamia cynthia.

family to which this moth belongs is called the Giant Silkworm family, because its members are so large—the largest of our *Lepidoptera*,—and because the silk of which the cocoons are made has been spun into thread. The silkworm of commerce, however, does not belong to this family, and is not a native of this country; neither is the Ailantus worm,—it was originally imported from Asia, perhaps from China, like the real silkworm.

The cocoons of this species are found on many different kinds of trees. A little whiteash tree near my garden wall had one year nine of them, each rolled Moth. in a leaf, and fastened to the branch by a silk band extending up the petiole of the leaf. They have at the top a contrivance like a valve, to let the inmate crawl out when he is



FIG. 42. PROMETHEA CATERPILLAR.

ready, without first making a door for himself, as most other moths do. The larvæ are bluegreen, with yellowish legs. Rows of black

knobs run lengthwise of the body; there are also four large red knobs on the thorax, and one large yellow one on the abdomen. The caterpillar is two inches long, or more. The male and female moths are quite unlike. The female has reddish-brown wings, with a

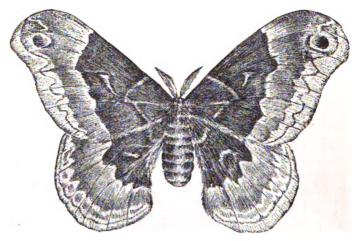


FIG. 43. PROMETHEA MOTH; FEMALE.

Callosamia promethea.

clay-coloured border, and crossed by a very dark band with wavy, whitish margins. There is a round spot near the apex of each fore wing, and each wing has a spot near the centre of the band. The male is very dark in colour, and the bands and spots are indistinct. His fore wings come to a curved point at the apex, while the female's wings have smooth, rounded outlines. The Promethea is the most common moth of its family.

The cocoons of the Promethea and Ailantus moths are long and rather slender, but the Cecropia cocoon is long and large and rough. It is not enclosed in a Moth. leaf, but is spun along a branch, to which it is fastened securely. The ends are pointed, and the silk extends well out on the wood. The larvæ are very large, sometimes four inches long. Their colour is blue-green, and they have rows of knobs, called tubercles,



FIG. 44. CECROPIA CATERPILLAR. Samia cecropia.

along the body. Those on the side are blue, those on the back are yellow, except the first and the last, which are blue, and those on the second and third rings of the thorax, which are red. All the knobs bear black bristles. The larvæ feed on many different forest and



FIG. 45. CECROPIA MOTH.

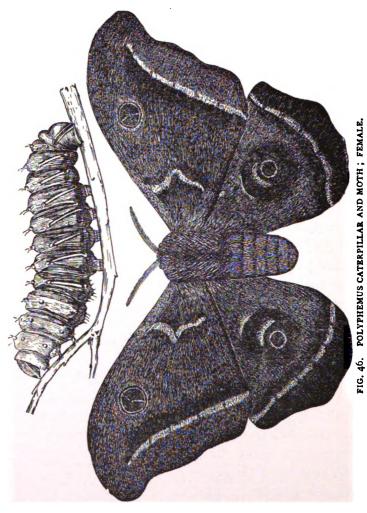
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fruit trees. I found two on one small branch of a young plum tree last summer, and the branch was so slender and the caterpillars so heavy that they bore it down as if they had been fruit. That was what attracted my notice, because it was not the time for plums. These larvæ often die in moulting, as do other knobbed or horned caterpillars. The moth is the largest of its family, individuals sometimes measuring six and a half inches across the open wings. The wings are brownish, with clay-coloured margin, and are crossed by a white band with red edges. Each wing is marked by a red-and-white crescent, and near the apex of each fore wing is a red spot, fenced off by a short zigzag line. This moth is very quiet in captivity. I have never known it to eat, and it seems to have no tongue. Mrs. Ballard says it will live three weeks without eating.

The cocoon of this moth is quite different from the last three. It is large, but short, and blunt at the ends. It is enclosed in a leaf but not attached to the branch.

Its silk has been used for thread.

The larvæ feed on many of our common fruit and forest trees. They are three



 POLYPHEMUS CATERPILLAR AND MOTH; FEM Tiles polyphemus.
 Antennæ of male more widely feathered.

inches or more in length, and bear many small orange knobs. The body colour is light green, and on each side of each ring in the abdomen, except the first and the last, is a slanting yellow line. On the last ring is a purplish V. The caterpillars are contented creatures, and eat their food and spin their cocoons as quietly in a box as in freedom. They leave their cocoons through a large hole in the end, first moistening and then breaking the threads. The moth is nearly as large as the Cecropia. It has a furry body, feathery yellow antennæ, and yellowish-brown wings. Each wing is crossed by a dusky band with a pink outside margin. Each has also a transparent spot surrounded by black and yellow rings. On each fore wing there is a gray border at the front edge, and a reddish mark with a pink or white edge, near the body. On the hind wings there are blue scales. The eggs are flat, round, quite large, of a chocolate-brown colour. They are laid in large numbers, a hundred or more, on oak, elm, willow, birch, maple, etc.

This is a very beautiful moth of a light-green colour, with long, curved tails on the hind wings. Each wing has a spot with a transparent centre, those of the hind wings the larger. Along the front margin

of the fore wings is a narrow border of purplish brown. The larvæ are pale blue-green, with a yellow stripe along each side and a

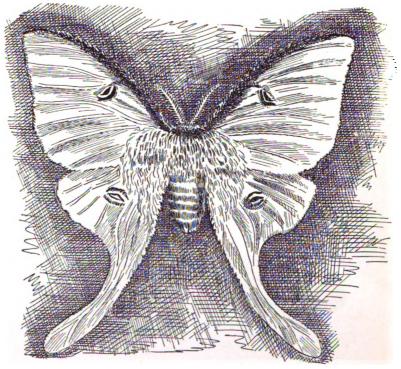


FIG. 47. LUNA MOTH.

Tropæa luna.

short yellow line across the back between each two rings of the abdomen. The head is grayish white. They feed on walnut and other trees, and make a cocoon shaped like that of the Cecropia, but much thinner.

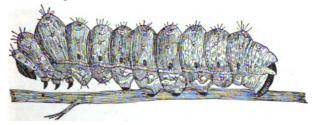


FIG. 48. LUNA CATERPILLAR.

Tropæa luna.

The caterpillar of this moth has poisonous spines on his body, so you must not be rash in making his acquaintance. He is green, and along each side runs a broad, reddish-brown stripe with white edges. The spines grow in tufts, and are black-tipped.



FIG. 49. IO CATERPILLAR.

Automoris io.

He feeds on elm, cherry, and other trees, also on corn, clover, hops, and cotton. He is two or three inches long. He belongs to what are called "processionary" caterpillars, which travel about in a procession, made up of a single file, or double, or more. The moth is

not as large as others of his family, but is distinctly showy. The male is deep yellow, with purplish-red spots on each wing. The female is larger and darker. Her fore wings are purplish red, and she has yellowish-brown eye-



FIG. 50. IO MOTH; FEMALE,

Automeris io.

Male rather smaller.

spots on each hind wing. In spite of the difference in colour, however, the male and female resemble each other strongly. These moths have no tongue, and can not eat. The eggs are laid in clusters, on the lower side of leaves.

#### FAMILY BOMBYC'IDÆ

The caterpillar is dark in colour, nearly black. Its body bears tubercles, from each of which grow bristly hairs. Both tubercles and hairs are shed with the first skin, and the colour grows lighter, till the caterpillar is a

yellowish white. His food is the foliage of the white mulberry, but he can be fed on the black



FIG. 51. SILKWORM.

Bombyx mori.

mulberry, on the osageorange, or even, for a short time, on lettuce. He is a delicate creature, and subject to disease, so that raising

him for his silk is a difficult and often expensive enterprise. The cocoon is a dainty, yellow-white affair, smaller in the middle, shaped almost exactly like a short, fat peanut. The moth is cream-white, with faint darker markings across the wings. His body is very furry.

#### FAMILY CITHERONI'IDÆ

The name is well given to this handsomest and largest of its family, who are all Royal Moths. The larva is the largest Regal Moth. caterpillar native to our country, and is sometimes five inches long. He has long spines up and down his body. When he is ready to transform, he does not make a cocoon, but he crawls down the tree on whose leaves he

has been feeding, and buries himself in the ground, where he changes into a dark-brown pupa. When the pupa stage draws to an end, the pupa works its way to the surface and bursts into a new life as a magnificent moth,

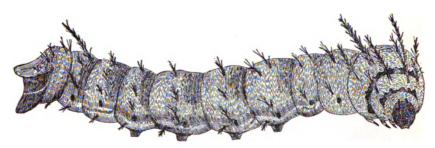


FIG. 52. CATERPILLAR OF REGAL MOTH; KNOWN ALSO AS ROVAL HORNED CATERPILLAR.

Citheronia regulis.

measuring five or six inches across. It has a stout, furry body, and strong wings. The fore wings are olive, with yellow spots and redbordered veins. The hind wings have yellow spots on an orange-red ground.

The caterpillar of this moth is a good deal like that of the Regal, in having long spines on the thorax. They are black, and start from yellow knobs. The body is thinly covered with hairs. It is green, reddish along the back, and has reddishyellow feet and head. It may be taken in

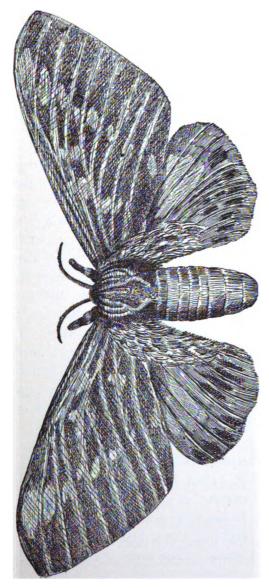


FIG. 53. REGAL MOTH.

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August and September, feeding on butternut, sycamore, hickory, and some other trees. The moth is almost as large as the Regal. It has wings of bright yellow, with spots and stripes of purple brown.

This moth expands two or two and a half inches, the female being larger than the male. It is found principally in the south. Two-It has pink upper hind wings and coloured Royal Moth. under fore wings, and the upper fore wings and under hind wings are yellow brown with small dark spots. The fore wings have a dark spot on the upper surface, and there are sometimes two tiny white specks on the dark spot. The antennæ are amber. The moth is quiet, like most of the large moths, and has a fat body covered with fluffy hairs. It lays many oval, transparent, light-green eggs. The larvæ eat the leaves of honey-locust, and of the Kentucky coffee-tree.

The caterpillar of this moth lives on maple trees, and is called the Green-striped Mapleworm. It is light yellowish-green. It has fifteen stripes along its body, eight of them light green, seven of them very dark green, almost black. It has

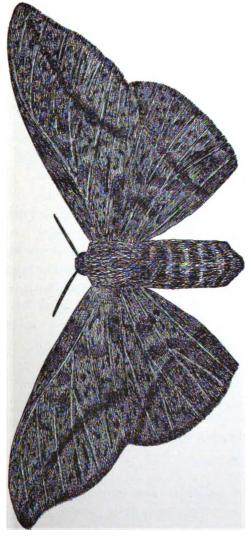
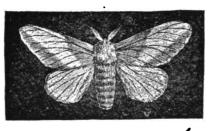


FIG. 54. IMPERIAL MOTH.

Basilona imperialis.

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two rows of spines on each side, two horns on its thorax, and four large spines on the hinder



I 2 2



FIG. 55. ROSY DRYOCAMPA, AND LARVA.

Dryocampa rubicunda.

part of its back. It buries itself to transform, and spends the winter in the ground. The moth has light-yellow wings with pink stripes. Sometimes

there is more pink than yellow, and occasionally the hind wings have no pink at all. The eggs are laid on the maple leaves, light-green, glassy little things, a dozen or more together.

Another genus of this family includes the Oak-worms, three species of which are found in the eastern States,—the Rosy-striped, the Orange-striped, and the Spiny. All live on oak leaves.

The caterpillar is a greenish gray, striped with pink, or with yellowish brown. Its skin is covered with tiny white knobs. It has

short, spiny hairs scattered over its body, and two long ones on its back. The female moth



FEMALE. Anisota virginiensis. Male smaller, wings not barred.

nearly transhas parent wings, of Rosy-striped Oak-worm. mingled shading of purplered and dull yellow. The male is smaller. his wings are rather FIG. 56. ROSY-STRIPED OAK-WORM; brownish than red. and are transparent only in the central

portion. Both sexes have a white spot on each fore wing.

This larva is black, and has two orange stripes on each side, and four on the back. The moths are much like the last species, but the wings are less trans- striped Oakworm. parent, the male's not at all so, and the female has small dark spots scattered over hers.

### FAMILY HEMILEU'CIDÆ

This is found in the eastern part of the country, by which is generally meant, east of the Rocky Mountains. The caterpillar Mais Moth. lives on oak. It is nearly black, and has a yellow line along each side. It bears

many branching spines. The moth has black

wings crossed by a white stripe. Some of the veins are white with black borders. The wings are somewhat transparent. Its body is furry.



FIG. 57. MAIA MOTH; FEMALE.
ALSO CALLED BUCK-MOTH.

Hemileuca maia.

### FAMILY NOCTUIDÆ

These moths are known as Owlets because they have very bright eyes that shine in the darkness, and because they fly at night, like owls. There are nearly two thousand species of Owlets. No other family of *Lepidoptera* is as large. When you leave your window open at night, and keep a bright light to attract moths, most of those that come in will be Owlets.

This is the largest of the Noctuids, but it is not often found in this country. Its home is Black Witch. the West Indies, and the few specimens that have been taken in different parts of the United States are supposed to have wandered from those islands or perhaps

from Mexico. It is not impossible that you may find one sometime, for they have been taken on the Pacific coast and in Canada. They are dark brown, sprinkled with gray. On each fore wing there is a black spot with blue scales in it, and surrounded by a reddish-yellow border. The antennæ are thread-like. This moth often expands six inches or more.

This moth has no popular name. It belongs to a group called Deltoids, because their wings when folded make almost a Pseudatriangle, which is the shape of the glos'sa lubri-Greek letter delta. Perhaps you ca'lis. have learned in geography why a river that has many mouths spreading out like an open



FIG. 58.

Pseudagiossa lubricalis.

fan, is said to have a delta. The commonest of the Deltoids is the moth named above. The wings are brown, with yellow lines crossing them in irregular scallops, and the

fore wings are darker than the hind wings. The larvæ feed on grass and clover.

This is a very dark-brown moth. The fore wings are much narrower than the hind wings,

and are marked with gray on the outer half. The larva is a little green caterpillar with

white lines. It feeds on clover, from which it takes its name, but it also eats grass. It is very common.

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FIG. 59. CLOVER HYPENA.

Hypena scabra.

The fore wings are blended gray and brown, with fine dark-brown lines crossing them in sharp zigzags. The hind wings are deep pink with a broad black band, and a black border with a very light outer edge. The members of the genus to



FIG. 60. ILIA UNDERWING.

Catocala ilia.

which this moth belongs are all large, and all have the showy hind wings from which they are called Underwings. When at rest the hind wings are covered. The larvæ feed on different forest trees, and they, like the moths, are gray or brown, so that you need to look for them with sharp eyes.

This is so called on account of two parallel lines of white crossing its brown fore wings.



FIG. 61. TWO-LINED PARALLELIA.

Parallelia bistriaris.

The antennæ are Two-lined Parallelia. thread-like, as in most of the Owlets. The caterpillar is found on the maple tree.

This is the moth—a plain, dark moth of no particular beauty—that comes into our houses

in



FIG. 62. BLACK-C OWLET.

Noctua c-nigrum.

numbers as to make it-self a nuisance, getting

such

shut into window sashes and rolled up inside of shades in a

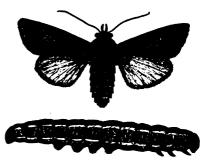
most reckless way. It is the moth of a common cutworm. If you live in the country you know the great family of cutworms, to your sorrow, for corn, cabbages, tomatoes, and

other plants of the garden and flower beds are cut down by them without mercy. Every cutworm develops into some kind of Owlet moth, which flies about through the summer months, then lays its eggs, and dies when cold weather comes.

This is another common moth. The hind wings are light, dull yellow, the fore wings

zebra Cater- w i t h pillar. t w o

light marks on each. The larva is a smooth, yellow caterpillar, with three black stripes on back



and sides, and Fig. 63. ZEBRA CATERPILLAR, AND MOTH.

White marks on

the stripes. It feeds on garden vegetables, and often does much harm.

This is another pest, a serious plague when it comes in large numbers, as it often does.

The moth is brown, with a white spot in each fore wing, and the caterpillar is about one and a half inches long,

covered with lengthwise stripes of black, green, and yellow. It takes its name from its habit

of marching in armies from place to place, and these armies utterly destroy the grass and growing grain wherever they They are pass. collected sometimes by the bushel from ditches dug to stop



FIG. 64. FEMALE.

Leucania unipuncta. Male has tuft at end of abdomen.



FIG. 65. ARMY-WORM, LARVA. Leucania unipuncta.

their progress. are found in all the eastern States. go into the ground to transform to pupæ.

Sometimes in late summer or autumn this moth is found even in the far northern States, but it was not born there; it has Cotton wandered from its home in the south, Worm. where it is a serious pest, doing a great deal of harm to the cotton-plant on the leaves of which it feeds. The flattish, ribbed eggs are laid on the under side of the leaves, and the caterpillars, five or six broods a year, grow very fast. The moth is a light olive

brown. The fore wings bear two little white spots on each, another bluish spot, and two wavy dark lines.

It is called a looper because, having prolegs only at the end of its abdomen, it walks

by making a loop of itself. Such caterpil-

lars are also called measuring-worms, inchworms, and "hitchworms," but loopers is the best name for

them. This species



FIG. 66. CLOVER LOOPER.

Drasteria erechtea.

feeds on clover. The moth is very common in open fields. Its fore wings are grey, crossed by two broad dark bands.

This moth is named from the scalloped outer

edges of its fore wings. In colour they are

Scalloped Owlet. they are grey-brown

with a reddish tinge, and a little

FIG. 67. SCALLOPED OWLET.

Scoleopteryx libatrix.

white along the front edges. Each has two

# American Dagger. Poplar Dagger 131

white lines across it, one double, one single, and a rust-coloured spot at the base. hind wings of these, and most of the Owlets, are plain and dull in colour. The caterpillars feed on willow leaves which are a favourite food with many caterpillars.

The larva of this moth is one of the worst pests to cabbage and other plants of the same order. It is a light-green caterpil-Cabbage lar, nearly naked, with yellow on Plusia. its sides, and a reddish spot on each



Plusia brassica.

on each fore wing.

side of its head. The moth has dark wings with a silvery dot and other slight marks on each fore wing. It has FIG. 68. CABBAGE PLUSIA; MALE. very slender antennæ.

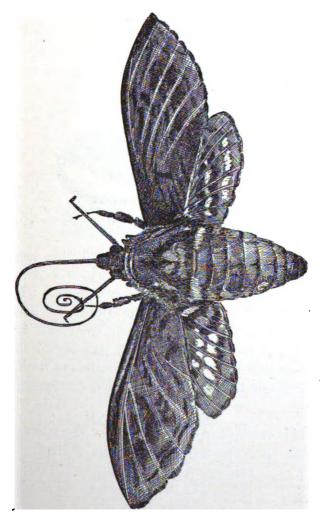
Another common species of the genus Plusia has a silver comma

The Daggers are so called because they have a dark spot shaped like a dagger on each fore wing. This species is a vellowish grey with some faint dark lines on the fore wings. You will Poplar Dagfind the larva curled up on a maple or an elm leaf, a hairy, yellow creature with five slender tufts of long black hairs. It feeds also on the cottonwood or poplar, from which it receives one of its names.

### FAMILY SPHIN'GIDÆ

These are called Hawk-moths because their wings are narrow, long, and strong, like those of a hawk. They are also called Humming-bird moths because they hover over a flower with a loud humming noise, made by the rapid vibration of their wings. They fly in the twilight. The larvæ have a comical way of raising the front part of the body, holding the head down, and keeping the attitude for hours without stirring.

Every country child knows the tomatoworm, a large green caterpillar that strips the tomato-plants of their leaves and Tomatoworm. Five-makes them look like skeletons. has a slender, sharp horn curving spotted Sphinx. backward, on the rear end of its body, for which no use has ever been discovered. On its sides it has seven yellowish lines, slanting downward and forward. The moth is large and very beautiful; sometimes its open wings measure five inches across. Its colours are various shades of grey. The fore wings are crossed by four dark lines; the



NO. 69. FIVE-SPOTIED SPHINX. MOTH OF TOMATO-WORM.

Phiezethoniius celeus.

thorax is covered with wavy lines of black and white; there is a black line along the middle of the grey abdomen, and five black-bordered orange spots on each side. The pupa of this moth is dark brown, pointed at the rear end. The outline of the wings, etc., is plainly seen



FIG. 70. CHRYSALIS OF TOMATO-WORM. (LARVA OF NO. 69.)

Phlegethontius celeus.

through the horny covering, and the long tongue has a case of its own which is bent round in the shape of a pitcher-handle. The caterpillar transforms in the ground. This and other caterpillars of the *Sphingidæ* are subject to the attacks of a tiny parasite of the *Hymenoptera*, the little white cocoons of which may often be seen covering the caterpillar's body.

This caterpillar is so nearly like the tomatoworm that the two species can scarcely be told apart; but the moths are different. The tobacco-worm is shaded brown rather than grey; the hind wings have dark lines across them, but the

lines are not so sharply zigzagged, and sometimes there is one broad stripe instead of four narrow ones. There is also a white spot on



FIG. 71. a. CAROLINA SPHINX.

Phlegethontius carolina.
b. TOBACCO-WORM.

each fore wing. The caterpillars of both will eat tomato, tobacco, and potato leaves, which all belong to one botanical order.

The name is given on account of three parallel white lines along each side of the thorax, the outer one extending forward above the eyes. Many of the veins are bordered with white. The fore wings are olive green, with broken patches of black and white. They are tinged faintly with pink, and crossed from body to tip by a band of buff. The hind wings are very dark, and

are crossed by a reddish stripe. The body is greenish brown, with black spots. The legs are a soft grey, and the tiny claws are black. This moth is a very swift flier. It gathers

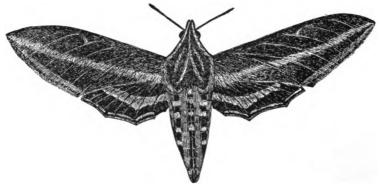




FIG. 73. CATERPILLAR OF WHITE-LINED SPHINX.

Deilephila lineata.

honey from primroses, four-o'clocks, and other garden flowers. The pupa is brown, and pointed at the ends. The larvæ vary a good deal, but are large, yellowish green, striped and spotted with yellow and black. Each has a straight horn near its tail.

This species is named from an imaginary resemblance to a fat hog, two segments of the thorax being much swollen. There Hog-caterare several Hog-caterpillars. This pillar of the one feeds on grape leaves. It is Vine. green, with a row of yellow spots, each with a

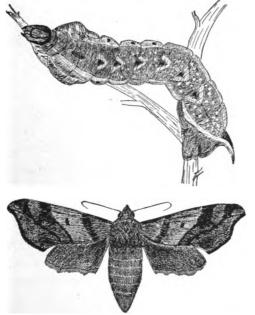


FIG. 74. GREEN GRAPE-VINE SPHINX. HOG-CATERPILLAR OF THE VINE.

Ampelophaga myron.

pinkish-purple centre, along the back. Either side of these spots is a white stripe with green edges, and there are seven diagonal lines on each side of the body, as in most of the sphinx larvæ. The moth is a little over two inches across the wings. The fore wings are grey with an olive shade, and have bands and spots of brighter olive. The hind wings are rust red. The moth frequents honeysuckle. The eggs are large, globular, greenish yellow, and are laid singly on grape leaves. There are two broods in a season. The caterpillars do not bury themselves, but make a flimsy cocoon of leaves and silk.

The larva is a pale-green caterpillar, covered with delicate white points, like frost. It feeds on poplar leaves. The moth is very beautiful. Its fore wings are of different shades of olive, and its hind wings are olive, red, blue, and black.

This is another of the Hog-caterpillars, feeding on grape leaves and Virginia creeper. It has on each side six creamy spots.

Pando'rus
Sphinx.

The body colour changes, as it grows, from dull pink to red brown.

Like other sphinx larvæ it has a horn on its rear end, which grows short and curly, and at last disappears, a curious round black spot, like a staring eye, taking its place. This



FIG. 75. MODEST SPHINX.
Marumba modesta.

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FIG. 76. PANDORUS SPHINX. SATELLITE SPHINX.

Philampelus pandorus.

caterpillar has the power, like other Hog-caterpillars, of drawing its head back into its thorax till you would scarcely know that it had a head. It transforms in the ground. It much resembles the larva of the next species. The moth is one of the largest. It is covered with beautiful harmonious tints of grey and olive, shading into light yellow at the edges of the wings, and sometimes flushed with pink.

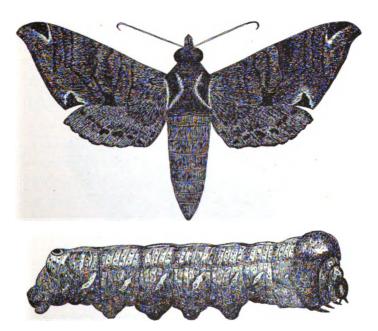


FIG. 77. ACHEMON SPHINX, AND LARVA.

Philampelus achemon.

This is also a Hog-caterpillar. It feeds, like the Pandorus, on grape and Virginia creeper. It is light blue-green, with six lighter spots on each side. The moth has wings of shaded olive and grey, with three distinct dark spots on each fore wing, and a short row of smaller ones on the margin of each hind wing.

The caterpillar is found on willow, ash, elm, apple, and plum trees. The fore wings of the moth are grey, with brown tips and Twin-spotted markings, often shading into pink.

The hind wings are grey or light brown, with deep rose colour in the central



FIG. 78. TWIN-SPOTTED SPHINX.

Smerinthus geminatus.

portion, and two sky-blue spots on a larger black one, near the anal angle. This is a common member of a group of Hawk-moths, named from their partly transparent wings. The colour of the parts not transparent is dark redbrown, and a short brown line projects from the costal margin of each fore wing into the transparent central portion. The

caterpillars feed on snowball and snowberry. These moths have the stout, spindleshaped body, the thickened antennæ, the long, nar-



FIG. 79. THYSBE CLEAR-WING.

Hemaris thysbe.

row wings, and strong flight that distinguish the Hawk-moths. They should not be confounded with the family Sesi'idæ, or Clear-wings, to which they are not related, and which they resemble only in the partly transparent wings.

### FAMILY THYRID'IDÆ

This species has rusty black wings spotted

with reddish yellow. Each wing has also a white spot which is almost transparent. The wings

Spotted Thyris.

Thyris maculata. have deep scallops on the edges. On account of the transparent spots the name

Window-wings has been given to the family to which this moth belongs. The larva is not known.

### FAMILY LITHOSI'IDÆ

These are called Footman-moths, because most of them wear sober colours, like those of a footman's livery; though some of the insects are bright.

This is a small moth. The ground colour

is a dull blue-grey; but pink hind

wings, and a broad Banded yellow band on the Footman. fore wings, make him

FIG. 81.

The hind wings have BANDED FOOTMAN. very gay. grey tips.

You may find the larva of this species feed-

ing on the under side of lichens.

on trees. It Striped Footman. is dark coloured, with yellow dots and lines, and has a thin covering of stiff



FIG. 82. STRIPED FOOTMAN. Hypoprepia miniata.

black hairs. The moth is much larger than the Banded Footman, and much gayer.

fore wings are bright red, with three blue-grey stripes, and the inner half of the hind wings is red.

### FAMILY AGARIS'TIDÆ

The popular name for this family is Wood-nymphs.

The caterpillar, like most of the Woodnymphs, lives on grape and Virginia creeper. It winds a thread round a growing end of the vine, and eats it at its leisure. It is of a pale bluish colour,

and each segment of its body bears eight alternately light and dark lines, with a deep yellow line in the middle. The moth is velvety black with a broad yellowish spot

on each fore wing, and a brick-red or orange patch on each hind wing. It expands a little over one inch.

FIG. 83.
GRAPE-VINE EPIMENIS, AND
LARVA.
Psychomorpha epimenis.

This is a small black moth, with two yellow spots on each fore wing, and two white spots on each hind wing. Its legs are black and yellow. The food of the Eight-spotlarva is grape leaves, but like many

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grape-feeders it will also eat Virginia creeper.



FIG. 84. EIGHT-SPOTTED FORESTER. Alypia octomaculata.

Its colour is white, with an orange ring on each segment, and four dark lines each side of the orange, nine in all. It resembles the larva of the Epimenis.

This caterpillar is much like the last two and its food and habits are about the same,

Beautiful Woodnymph. but it has six dark lines on each segment, instead of eight. The moth flies in June and July. It has smooth,

creamy fore wings, with a broad, purple-brown

border on the outer edge and most of the front edge. There is a narrow line of greenish olive on the inner margin of the border, and an olive



margin of the bor- FIG. 85. BEAUTIFUL WOOD-NYMPH.

spot on the inner margin of the wing. A wavy white line runs along in the border. The hind wings are yellow, with a brown border.

### FAMILY ARCTI'IDÆ

All the moths of this family are called Tigermoths because they generally have striped or spotted wings. The Isabella is very common, and in its larval form is found in the fall and spring, and indeed all winter, if you

look under boards and rubbish heaps Tiger-moth. where it delights to take its win-

ter nap. When asleep, or when alarmed, it curls up into a ball. It is very furry and

black, with a wide reddish band round the middle of the body. In the spring it wakes up, eats a while, and then wraps itself in a co-



FIG. 86. ISABELLA TIGER-MOTH. Pyrrharctia isabella.

coon of its own hair. The moth has a furry body, often dull yellow at the end, with three rows of black dots. The wings are yellowish, with black dots. The larvæ of this and the next species are often called "woolly bears," or bear caterpillars. They feed on various garden weeds, and are especially fond of the leaves of the trumpet-creeper.

This caterpillar is much like the last, except that it is generally yellow, and it has not the evenly clipped appearance of the Isabella.

It is very variable in colour, the light yellow being the commonest variety, and it can always be distinguished from the Isabella Yellow Bear. because it is without the black band Ermine Moth. round the body; though it often has lines on its sides. The cocoons are quite similar. The Ermine is a snow-white moth.





FIG. 87. AND ERMINE MOTH. Spilosoma virginica.

except that its wings have a few black dots, and its abdomen has rows of black dots with yellow stripes between the rows. Its head and thorax are fluffy. The YELLOW BEAR CATERPILLAR, eggs are vellow. turning green just before hatching. I

found one summer a colony of these moths, nearly fifty, on the outside of a window, imprisoned between the glass and a netting which had been nailed over the whole casing. have never yet solved the mystery of how they came there. No such number of caterpillars could have occcupied the place without having been seen by somebody, and even if that had been possible they could not have grown to maturity without something to eat, though they can fast a long time, when full-grown, without apparent inconvenience.

This is another common species, named, I

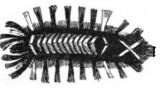




FIG. 88. HARLEQUIN MILKWEED CATERPILLAR, AND MOTH. Cycnia egle.

suppose, from the tufts of black. Harlequin white, and Milkweed Caterpillar. orange hairs which deck its body. The tufts near the head and tail are longer than the others. It makes a cocoon from its own hair. The moth is grey, with a vellow body and black

spots on its back. Its food is milkweed.

Like the Harlequin caterpillar this species

FIG. 89./ Halisidota caryæ.

is covered with tufts of hairs, but Hickory they are all Tiger-moth. black or It is common white. HICKORY TIGER-MOTH.) in midsummer, feeding on hickory and butter-

nut leaves. The cocoon is like the Harlequin.

Ky to fis gr

The moth has light ochre-yellow wings, and the fore wings are covered with almost transparent white spots.

This moth is very common in midsummer. I have often found it in hay-fields, left without shelter by the cutting of the grass.

Virgin Tiger-It attracts notice by the bright pink and black of its hind wings. The fore wings are pinkish buff, with broad black



FIG. 90. VIRGIN TIGER-MOTH.

Eyprepia virgo.

stripes and cross-bars, and the body has three black lines on the thorax, and a black band down the back of the abdomen. The under side of the body is covered with short, dark hairs. The larvæ are brown and hairy. They feed on pigweed and other equally common weeds.

You might think that this caterpillar was found only in salt marshes, but it is common all over the United States, and in

all over the United States, and in places that are neither salt nor marshy. It is yellow, and covered

Salt-marsh Caterpillar.

with long hairs which grow from tubercles. It feeds on grass, plantain, and other common



FIG. 91. SALT-MARSH CATERPILLAR.

Estigmene acraa.

weeds, and makes a yellowbrown cocoon, like most of the "woolly bears." The male moth has yellow hind wings, and his fore wings are

yellow below and white above; while the female has white wings. Both sexes, however, have many small black dots on their wings, and a row down the back of the abdomen.



PIG, 92. BELLA MOTH.

Utetheisa bella.

This is a very pretty moth, common in the eastern States. The fore wings are yellow, crossed by six white bands with black spots

in them. \ The hind wings are a deep pink,

W/V/S

bordered with black. A narrow white line separates the black from the pink.

### FAMILY LYMANTRI'IDÆ

These are called Tussock-moths because the larvæ are covered with tufts of hair. They are always bright-coloured.

This is a common species, and the caterpillar is very handsome. It has two slender plumes of long black hairs on the front part of its body, and a third on the hinder part. There are four short, thick tufts of creamy-white hairs on its back. The sides are covered with

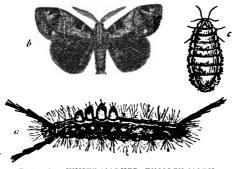


FIG. 93. WHITE-MARKED TUSSOCK-MOTH.

a. Larva. b. Male. c. Female.

Notolophus leucostigma.

long yellow hairs. There is a black stripe along the back, and a yellow one either side of the black one. The head is brilliant coralred, and there are two red glands on the hinder part of the back. These glands are thought to be scent organs. There are two broods of the caterpillars every season. When young they will drop to the ground if you disturb them, spinning a silk thread to hold by, and will climb up the thread again as soon as they feel safe. They live on various plants—rose, apple, horse-chestnut. The female moth has no wings, and looks like a fat, hairy, white She can not travel far, and she lays her eggs on the cocoon out of which she has just crawled. You can detect them by a frothy substance with which she covers them. male is plain grey, with dark wavy lines crossing the fore wings, and a small white spot on each. He is common in the hot days of early fall.

### FAMILY DREPAN'IDÆ

These are known as Hook-tip moths, from the hook-shaped apex of the fore wings. One of

the commonest is a small moth with a slender body, and whitish wings crossed by broken scalloped lines of dark brown. The caterpillar is said to feed on



FIG. 94. HOOK-TIP MOTH.

Platypteryx arcuata.

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white birch leaves. The moth has no popular name. If you must call it something, call it Platyp'teryx arcua'ta.

### FAMILY ENNOM'IDÆ

There are very many different kinds of loopers, or measuring-worms, divided into five families, all called Geom'etrids, perhaps because they do so much measuring. The caterpillars are familiar to many of us, but I am sure we have often looked at them without seeing them, for they have a way, when at rest, of sticking straight out from the twig to which they cling, and looking for all the world like stiff grey twigs themselves. Both their colour and their attitude protect them from their enemies. They will let go their hold, if disturbed, and drop to the ground by a silk thread, from which they are sometimes called drop-worms. They make either a very slight cocoon or none at all, burying themselves in the earth instead. The Ennom'idæ is the largest family of loopers.

This is a whitish caterpillar, striped with yellow and dotted with black. It has also little white marks on the sides. It comes in great numbers, grows very fast, and will strip a cur-



FIG. 95.
CURRANT SPAN-WORM MOTH.
Diastictis ribearia.

rant or gooseberry bush of leaves in a wofully short time. Span-worm. The moth has yellowish wings crossed by two irregular rows of dark spots.

It is so named because the larvæ feed on the leaves of evergreen trees, and the moth is



FIG. 96. EVERGREEN CLEORA. Cleora semiclusaria.

found near such trees in late summer and early fall.

Evergreen Cle'ora.

The caterpillar is yellow, with black spots on the back and four fine black lines on

each side. It makes a green-and-white-striped chrysalis. The moth is very pretty, white or dusky in colour, with black marks.

The notched margins of its wings explain



FIG. 97. NOTCHED-WING GEOMETER. Ennomos magnarius.

the name of this moth. It Notchedis large wing Geomfora Geometrid, and is reddish-yellow, with many tiny brown or black dots, and

two dark lines forming an indistinct brown margin, edged with dark fringe. The larva is found on birch, maple, and other trees. It is more than two inches in length, and looks like a twig of the tree it feeds on.

## FAMILY HYDRIOMEN'IDÆ

This is the next largest family of loopers.

The nests of the larvæ are often found on

wild cherry trees, enclosing a number of leaves

Scallop-shell which serve for food. The brown colour of the dead leaves makes the nest very noticeable. The caterpillar is black above and pinkish below, with



FIG. 98. SCALLOP-SHELL MOTH. Calocalpe undulata.

four white stripes lengthwise of the body. The wings of the moth are covered with fine brown and yellow lines in delicate scallops, from which it takes its name.

The larva of this moth has never been described. The moth is very pretty. It has black wings with white fringe, and striped Black a wide white stripe across the fore Moth. wings. It is found in all parts of our country.

# FAMILY MONOCTENI'IDÆ

To this family belong the hated Cankerworms which strip our fruit and shade trees of leaves, and then descend by tiny threads to transform in the ground, in such numbers that we can scarcely walk under an infested tree without being decorated with grey and black loopers. There are two species of Cankerworms, one appearing in the fall and one in the spring. The females of both species are wingless, and that is why you see elm and apple trees surrounded by a band of tar or printer's ink to prevent the moths from crawling up the trunk and laying their eggs in the crevices of the bark, or in the leaf-buds.

Only a few other species of this family are found in North America.

### FAMILY GEOMET'RIDÆ

This is a bright green looper that eats the

FIG. 99.

RASPBERRY GEOMETER.

Synchlora glaucaria.

fruit, and sometimes the leaves, of the raspberry. The

Raspberry Geometer.

moth is also green, with lighter green lines across the wings.

### FAMILY STER'RHIDÆ

This little looper lives on chickweed such

Chickweed Geometer. as a canary likes. The moth is small, with reddish-yellow

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wings banded and fringed FIG. 100. CHICKWEEL GEOMETER. With pink.

Hamatopis grataria.

This name comes from the very small

hind wings. Both pairs
of wings are
green. The
fore wings
have two white bands
crossing each, and the
hind wings have one.
The caterpillar belongs



FIG. 101. BAD-WING MOTH.

Dyspteris abortivaria.

to the leaf-rollers, and does much injury to the grape.

## FAMILY SESI'IDÆ

The wings of this family, covered but slightly with scales, are transparent. The moths are therefore called Clear-wings. The body has a fan-shaped tuft of hairs at the tip. The fore wings are long and narrow, and the moths are generally small and bright-coloured, resembling

wasps as they fly swiftly about in the hot sun among the blossoms. The family is large, and the larvæ are all borers. They infest fruit trees and bushes, often doing a great deal of "Peach gum" and "cherry gum" are thickened sap which has oozed out of the injured wood.

The moth of the Peachtree Borer is a deep metallic The female, which blue. is considerably larger than the male, has scales on the fore wings and an orange stripe around the abdomen.



PEACH-TREE BORER. Sannina exitiosa.

The larva of a moth very similar to this works in pine trees. You may detect its presence by a mass of mingled sawdust and pitch on the trunk of the tree. It is called the Pine Sesian.

The Currant-borer works in currant stems. The moth is small, deep blue, and flies swiftly about CURRANT-BORER. the bushes in midsummer.

Sesia tipuliformis.

The Pear-tree Borer is blue-black above and bright yellow beneath, and has three yellow stripes across the abdomen.

### FAMILY PTEROPHOR'IDÆ

These are small, delicate moths, having their wings slit up into plume-like lobes. They are called Plume-moths, or Feather-moths. You may find them by beating the bushes where they hide in the daytime. They will fly out quickly, but will soon alight again. They go abroad mostly in the evening, when it is warm and still.

This graceful little moth has the divided wings of its family, yellow-brown in colour,

Gartered Plume-moth. white. The body is Grape-vine slender. The legs are long, and look as if they had short branches at the lower joints. The caterpillar is about half an inch long. It is yellow-green, with yellow



FIG. 104. GARTERED PLUME-MOTH. Oxyptilus periscelidactylus.

knobs arranged in rows around its body, and a tuft of uneven hairs growing from each knob. The body has also a covering of very short, fine white hairs. The head is a yellower green than the body. The larva lives on grape leaves, drawing them loosely together with threads.

There is another family called Many-plume

moths, whose wings look as if slashed with scissors, but they are not common.

## FAMILY NOTODON'TIDÆ

Many of the larvæ of this family have decided humps, or protuberances, and some of the moths have a prominent point on the inner margin of the fore wings. For these reasons they have received the popular name of Prominents.

This is a common caterpillar, living on apple and other fruit trees. I found, at different



WORM, AND MOTH. Œdemasia concinna.

times in one Red-humped summer, two Apple-worm. thriving col- Red-humped Prominent. onies feeding on the tender leaves of a young plum tree, crowding the branch with their prickly bodies when FIG. 105. RED-HUMPED APPLE- they had eaten their fill. They have short black spines on the back and

sides, lines of black, white, and yellow along their bodies, a red head, and a red hump on the shoulders.

This caterpillar, like the last, has a red hump

and a red head, but the red is deeper and has an orange shade, and the hump is on the back

part of the abdomen.
The body is smooth, striped with lines of black, yellow, and lavender, and is

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FIG. 106. WHITE-TIPPED MOTH.

Edema albifrons.

pinkish underneath. The larva feeds on oak leaves. The moth is so named from a white patch which extends along the costal margin of the fore wings, two-thirds of the distance from the tip to the body.

These caterpillars are found in late
Yellownecked Apple. Su mtree Worm. mer, in colonies, on walnut, oak, apple, and other trees.
They are striped, chiefly black and yellow, and are somewhat hairy.
They have a way

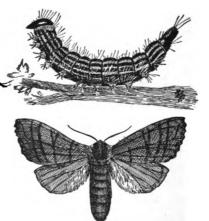


FIG. 107. YELLOW-NECKED APPLE-TREE
WORM, AND MOTH.

Datana ministra.

of bending up both ends of the body and clinging to the branch by their remaining feet. The moth is brown, with darker cross-lines on the fore wings and a dark spot on the thorax.

The larvæ are striped, black and yellow caterpillars, with two pairs of black knobs on the



FIG. 108. POPLAR MOCHA-STONE MOTH. Ichthyura inclusa.

back. They feed Poplar on poplar, in large Mocha-stone colonies. The moth is brown, with dull white and reddish lines on the wings. The fore wings have a brown spot near the apex, and some small black

spots near the edge. On the thorax there is a thick tuft of hairs of a dark colour, and the abdomen ends in a tuft shaped like a broom.

## FAMILY TORTRIC' IDÆ

The first word of this name is given because



CHERRY-TREE UGLY-NEST TORTRICID. Cacæcia cerasivorana.

the larva eats cherry leaves; the second because Cherry-tree nothing can be ug-Ugly-nest Tortricid. lier than the webs Cherry-tree he and his family weave on the branches, torn, dirty, disfigured with empty pupa skins or

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filled with squirming caterpillars; and the third, because he is a leaf-roller, or leaf-twister. His colour is yellow. The moth is also yellow, but the fore wings have darker spots and cross stripes of a bluish shade.

Another species of the Ugly-nest Tortricids feeds on oak leaves, and another on hickory and walnut.

The name of this caterpillar explains its
habits. It draws pine-needles toPine-leaf
Tube-builder. gether for a nest, in the shape of
a tube, and then feeds upon them.
The adult is a small, rust-coloured moth.

## FAMILY GRAPHOLITH' IDÆ

The larvæ of this family are also leaf-rollers, or Tortricids, and among them are some insects very injurious to fruit.

We have all met this moth in a larval state, the little, fat, white "worm" that lives at the core of apples, and makes them fall before they are ripe. The moth is a light grey, and sometimes

CODLIN MOTH. the grey has a pink shade. The Carpocapia pomonella. fore wings are covered with delicate markings,

and each has a brown spot at the outer edge, crossed by shining bands. It is really very pretty, but I am afraid the farmers whose fruit it spoils do not see its beauty. The eggs are laid in the blossom end of the apple or pear, and the larva, which hatches in a few days, eats its way to the core, where it stays about three weeks. Just before or just after the fruit drops, the larva crawls into a crevice in the bark and spins its cocoon.

This is a small moth. Its fore wings are dark russet, crossed with irregular grey stripes.



FIG. III.
PITCH-PINE RETINIA.
Retinia comstockiana.

The larva is a borer, a light Retinia. brown caterpillar with scattered hairs. It bores a tunnel along the centre of a small pitch-pine branch, and the sap oozes

out and makes a hard, rough mass. When you see one of these lumps, you may know what has been going on inside the branch.

## FAMILY. PYRAUS'TIDÆ

The moth has brownish-black, white-fringed wings, with a few white spots upon them. The

antennæ of the male look as if they had a knot tied in the middle, and the fe-

male has two white Grape Leaf- lines on the body. roller. The rings of the caterpillar's body are so distinctly marked that it looks Female has two white bands as if it were made of flat beads strung together. Its colour is green, and it jerks and



FIG. 112. GRAPE LEAF-ROLLER; MALE.

on the abdomen, generally two white spots on each hind wing, and no knotlike enlargement of the antennæ.

Desmia funeralis.

jumps in a lively way if you disturb it.

When a colony of these larvæ have taken possession of a basswood tree, it sometimes looks as if it were hung with tiny Basswood green rags, the rollers have cut so Leaf-roller. many leaves, turned half of each into a tube for a home, and left the other half dangling. These rollers are green caterpillars, with black heads and black on the thorax. The moth is pale yellow, with green markings shaded with metallic purple.

## FAMILY COS'SIDÆ

The larva is a naked caterpillar which bores into the wood of the locust as well as of other All the members of the family are bortrees. ers, and do much harm to shade trees.

one lines a part of its burrow with silk, and changes within it to a pupa, in which state it remains three years. The Carpenter-female moth is quite large; the male is much smaller. Both are a black-and-white



FIG. 113. LOCUST-TREE CARPENTER-MOTH; FEMALE.

Male much smaller and darker, with a large yellow spot on each hind wing.

Prionoxystus robiniæ.

grey, and the outer half of the male's hind wings is yellow.



FIG. 114. LEOPARD MOTH, WOOD LEOPARD,

Zeuzera pyrina,

The moth is large, with a white body and wings, sometimes yellowish, sprinkled with blue-black spots. It lays hundreds of blue-green eggs, which in time become large, hairy, brown and black caterpillars, with a red line on each ring of the body. They infest maple, apple, plum, pear, elm, and other trees.

#### FAMILY PSY'CHIDÆ

The larva is called a bag-worm because he lives in a bag made of little twigs, lined with silk, and suspended from a branch Evergreen by a thread, sometimes several feet long. He likes arbor vitæ or cedar best, but will feed on other trees if obliged to. He drags his house with him as he moves about, by sticking his head and front legs out of the opening; but when he is done growing he ties his bag fast to a twig, and goes out no more as a larva. When the pupa stage is ended, the male crawls out of a hole in the bottom of his bag, and flies away, a perfect moth, with a long body, short, transparent wings, and feathery antennæ; but the female, having no wings, stays in her bag, lays her eggs, and dies. The Evergreen bag-worm is found all over the northern part of the country. It is also called the Basket-worm. The larva is a rough, mottled, black-and-white cat-

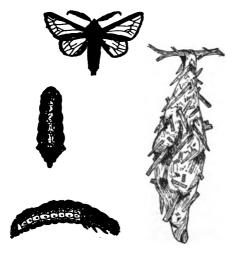


FIG. 115. RVERGREEN BAG-WORM.

1. Male moth. 2. Female moth. 3. Larva. 4. Bag.

Thyridopteryx ephemera formis.

erpillar. It begins to build its own little case as soon as it is born, and carries it about on its tail till both larva and case are full grown, when the caterpillar retires within the bag and transforms.

## FAMILY EUCLE'IDÆ

These larvæ are called Slug caterpillars because they are shaped much more like slugs than like caterpillars. Their prolegs are so short as to be invisible, and they glide along instead of crawling.

The name is given from a mark on the back like a purple-brown saddle on a green saddle-

cloth. Both saddle and cloth are edged with white. The rest of the body is reddish brown. It has a fringe of spines that sting like nettles. It feeds on cherry, oak, and other trees, also on



FIG. 116. SADDLE-BACK MOTH, AND CATERPILLAR. Empretia stimulea.

corn, cotton, and various plants. The moth is velvet brown, and has two golden yellow spots at the tip of each fore wing, and one near the base. It is quite rare.

This is a very curious caterpillar, receiving its name from its Skiff Caters shape, which is somewhat like a boat or skiff. Its colour is light green, and it has a large brown spot on its flat



FIG. 117. SKIFF CATERPILLAR, AND MOTH. Eulimacodes scapha,

back. There are long, fleshy spines near the head and tail. It feeds on walnut, oak, and other trees, and makes an odd chrysalis, like a beechnut in shape. The moth is light, reddish brown, and each fore wing has a tan-coloured border along the front edge, narrow at the base of the wing, widening suddenly, and coming to a point at the apex. It is not a rare moth.

## FAMILY MEGALOPYG'IDÆ



FIG. 118.
CRINKLED FLANNEL-MOTH; MALE.
Female larger, antennæ narrower.
Megalopyge crispata.



FIG. 119. COCOON OF CRINKLED FLANNEL-MOTH. Megalopyge crispata.

The name describes the moth exactly. Its Crinkled wings are Flannelmoth. covered with long, wavy hairs of a vellowish colour, like white flannel that has seen long service. Fine, crinkly lines of dark brown cross the fore wings. The antennæ are feathery. The larva is slug-like but densely hairy. It feeds on apple, oak,

elm, blackberry, raspberry, and possibly on other leaves.

#### FAMILY CRAM'BIDÆ

These are called Grass-moths, from their living in open fields among the grass; and Closewings, from their habit of rolling the wings

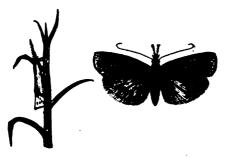


FIG. 120. A CLOSE-WING, OR GRASS-MOTH.

Crambus.

closely around the body when at rest. As you walk through the fields you will stir up numbers of them, and if you watch one

alight on a grass-stalk you will see that he always keeps his body parallel to it. The colours are inconspicuous, pale buff or silvery white, plain or in stripes. The whitish larvæ feed on grass, clover, and moss-roots, and live in little silk-lined nests on the ground. You will not often find them.

## FAMILY LASIOCAM'PIDÆ

Two groups of moths, the larvæ of which are known respectively as Tent-caterpillars and Lappet-caterpillars, make up this family.

You know this species well if you have ever

seen on apple or wild cherry trees their disfiguring, tent-like webs, or the bare branches stripped of leaves by the swarming Orchard larvæ. Before the leaf-buds begin Tent-caterto unfold in the spring you may often see the tiny webs glistening white in the

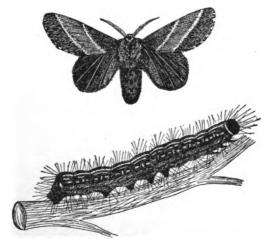


FIG. 121. APPLE-TREE TENT-CATERPILLAR, AND MOTH; FEMALE.

Male smaller, antennæ more feathery.

Clisiocampa americana.

fork of a branch, but both webs and caterpillars grow with marvellous rapidity, until the nest is a foot, and often two, in length, and the caterpillar nearly two inches. The web increases in size by new layers of silk, with space between the layers for the inmates to

crawl around. The doors of the house are at either end. The caterpillars stay in the house at night, and in cold or stormy weather. About nine o'clock on pleasant days they come out in a procession, go back for a rest at noon, and feed again in the afternoon, retiring for the night before sunset. When full-grown they are black and hairy, with a white stripe down the back, and yellow lines and pale blue spots on the sides. In June they leave the web and crawl away to transform, making cocoons of silk mixed with a yellowish powder. moth is not so well known. Its colour is rusty brown, with oblique yellow-white lines across the fore wings. The female expands about one and three-fourths inches: the male is smaller. The eggs are laid in late summer, in a close ring about a twig. They are covered with a substance that protects them from the winter weather, and they hatch in the spring. This species is also called the Apple-tree Tentcaterpillar. There is another species called the Forest Tent-caterpillar, which lives chiefly on forest trees, and differs slightly from the first species in markings.

The Lappet-caterpillars are so called because they have, low down on each side of each segment, a tubercle shaped like a little flap or lappet. From these lappets grow long grey and black hairs, forming a fringe along each side of the body. Lappet-moth. The larva of the American Lappet-moth is an ash-grey caterpillar, broad and rounded above and flat beneath. It feeds only at night, and lies quiet all day, looking exactly like a swelling on the bark of the tree. On



FIG. 122. AMERICAN LAPPET-MOTH; MALE. Phyllodesma americana.

the under side it is orange and black, and on the second and third segments you will see, when the caterpillar is crawling, but not otherwise, narrow bands of Female larger, markings less distinct. bright scarlet with three black spots in each. It

is about two and one-half inches long and half an inch broad. It feeds on apple, cherry, ash, oak, maple, and some other leaves. The moth is red-brown, with a white-margined notch on the inner edge of the fore wing, and the costal edge of the hind wing. Sometimes, not always, a pale band, bordered with broken, dark brown lines, crosses both wings.

The larva is much like the preceding, but its

colour is blue-grey, with many pale lines running lengthwise. Instead of two scarlet bands,

it has one black one on the third seg-Lappet-moth. It feeds on apple, elm, poplar, and other trees. The moth has a large, thick, white body, with FIG. 123. VELLEDA LAPPETa large blackish spot on its back. The wings are dark grey, crossed by wavy white lines.

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MOTH: MALE. Female nearly twice as large. Tolype velleda.

Neither of the lappet-moths is at all common.

## SUPERFAMILY TINEI'NA

This is a very large group of very small insects. They have narrow, fringed wings, slender bodies, and often a metallic lustre like gold or silver. The larvæ are mostly leafminers, living inside of leaves, and making long, narrow, winding tunnels in the tissue without ever breaking through to the outside. This shows how very tiny they are, because there is not much room between the two surfaces of a leaf. Among these miners there is one species infesting maple leaves, another oak, another apple, another pine, and small as they all are they have most curious habits. Other larvæ make galls on the stems of plants, as the goldenrod, though not all the galls on goldenrod or on other plants are made by Tineids. Others infest grain, or dried fruit, or feathers, fur, and woollen goods, the last being known as Clothes-moths. You will not do much at first with Tineids, they are so minute and delicate, though you will often see the stems of plants bearing an ugly swelling, or the leaves of trees disfigured by blotches or by irregular tunnels, the work of Tineid larvæ.





#### ORDER COLEOP'TERA

(SHEATH-WINGS)

THIS order is subdivided into real beetles and snout-beetles. It includes over eleven thousand species, arranged in about eighty families, of which seventy or more are true beetles.

True beetles have two strong membranous wings, which when at rest are folded and tucked away under two horny wing-shaped covers or shields, called el'ytra. The elytra are raised and separated in flight, and lie together in a straight line along the back when at rest. The running-beetles have no wings, because they do not need them, and in some the elytra have grown together, and only shield the back. The mouths of beetles are made for biting, and the mandibles are strong jaws with which they seize their prey, or gnaw the solid substances upon which some of them feed, or within which they make their homes.

The larvæ are called grubs. They have

three pairs of jointed legs on the thorax, which develop into those possessed by the full-grown beetle, but instead of many prolegs, as some Lepidoptera have, they often possess only one at the tip of the abdomen. Some larvæ manufacture a kind of glue with which they stick together earth or bits of wood for a kind of cocoon. Others make tunnels in wood and transform within them.

The snout-beetles are much like true beetles, except that the head is prolonged into a snout or beak which is sometimes longer than all the rest of the body. The larvæ may be known by having no jointed legs at all.

## FAMILY CERAMBYC'IDÆ

These are known as Lon'gicorns, or Long-horned beetles, the antennæ being very long, in one species four times as long as the body.



FIG. 124.
CLOAKED KNOTTY-HORN.
Desmocerus palliatus.

They also have long legs. The larvæ are soft-bodied, yellowish-white borers.

The antennæ are long and knotty or Cloaked knobby, and the Knotty-horn. elytra are yellow at the base, as if the

beetle wore a short, yellow shoulder-cloak. The rest of its body is changeable blue and green. It is very handsome. The larvæ bore in the pith of elder, and the beetles may be found on the bush in early summer.

Professor Comstock says he has seen a pine

tree eight inches in diameter bored

through and through by the larvæ of these beetles.

They make a cocoon of chips, from which in the spring emerges a grey and black beetle, with three ribs or ridges along each wing-cover, a sharp point on



FIG. 125.
RIBBED PINEBORER.
Rhagium linea-

each edge of the thorax, and short antennæ. This beetle leaves the pupa-case in the fall, but stays in the tree all winter and comes out in the spring to begin the mischief

all over again.

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Ribbed

Pine-borer.

This handsome beetle lays its eggs in summer, in the wood of the sugar-maple,

Beautiful and the larvæ bore in every direction, doing much harm to the tree.

The adult is black, with various

FIG. 126. BEAUTIFUL MAPLE-BORER.

bands and other marks of bright yellow. The antennæ are of medium length, stout and knotty.



FIG. 127. LOCUST-BORER. Cyllene robinia.

This beetle is black, with narrow, wavy, yellow marks across its back. The legs are red. The Locust-borer. antennæ are long and knobby. The beetle devotes its attention chiefly to the locust tree, but it may also be found in early fall on the goldenrod.

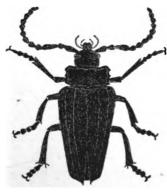


FIG. 128.

BROAD-NECKED PRIONUS.

Prionus laticollis.

This is a very large, pitchy-black beetle, with stout, knobby an-Broad-necked Prio'nus. tennæ, and a thorax with jagged edges. The body is broad in proportion to its length. The larva is a particularly fat, white grub, and may be found about the roots of apple, poplar,

balm of Gilead, and other trees, and often at the roots of grape-vines.

In general shape this beetle is like the broad-necked, but the colour is mahogany brown, almost yellow on the under bodied Prio- side of the abdomen, and the closed elytra are nearly as wide at the end as at the base. There are three sharp spines

on each side of the thorax. and the mouth has two sharp, sickle-shaped mandibles that work viciously if you disturb the beetle while in captivity. In midsummer, especially during August, these beetles will often fly in at a lighted window, with a great buzz of wings and clatter of claws. I have also found them many times, after a heavy STRAIGHT-BODIED PRIONUS. shower in the night,



Orthosoma brunneum.

drowned in vessels of rain-water. A specimen obtained in this way is quite sure to be perfect, but it should be placed in the poison bottle for some time before pinning, because large beetles are very tenacious of life, and are often not so dead as you think them. you leave a drowned Prionus, or a stag-beetle to dry while you go about something else, it is quite possible that you will never see him again.

A good way to examine this, or any insect that will not fly away, is to put him into an open cup or bowl. His claws can get no grip on the smooth surface, and his efforts to crawl will show off his structure and characteristic motions to fine advantage. It is unkind, however, to keep him there too long, for he grows very tired and discouraged.

You can recognise the Sawyer by its long

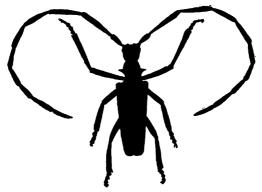


FIG. 130. THE SAWYER; MAI.E.
The female has antennæ about half as long.
Monohammus confusor.

antennæ, which in the male are twice as long as the whole body. The thorax has a sharp point on each side. The The Sawyer. colour is grey and brown in broken stripes and

mottling. Its body is rather slender. The "sawing," from which this beetle is named, is done by the larvæ in the trunks of evergreen trees. They make large holes, sometimes so large as to kill the tree.

This is a red beetle of medium size, rather

broad for its length, with four black spots on each weed-beetle. elytron, or wingcover. The antennæ are black. You will find the beetles, often in numbers. on the milkweed at whose



base the larvæ bore for a living.

## FAMILY CICINDEL'IDÆ

Everybody who notices anything about insects has noticed these beetles, known familiarly as Tiger-beetles. They are as fierce among insects as the tiger among animals, and some of them have spots on the body a little like a tiger's spots. They like hot weather, and you will find them in sandy places and on hard-trodden paths, where the sun shines the hottest. They can both run and fly, and are remarkably quick in their motions, so that you can seldom get your hand on one. He will dart away just as you think you have him, and if you find him at all, you will find him alighted at a little distance, always with his head toward you, and his prominent eyes taking in all your preparations for catching him.

As a family the tiger-beetles are noted for their brilliant colours. Some of the commonest are bright bronze or blue-green, though

some, especially those living in sandy places, are grey, and others are black. Most of them have little dots and lines of a different colour on the wingcovers. One familiar species is a metallic green with purple lights, and has two pale yellow dots on the edge of each elytron.

The larva is as greedy and fierce as the beetle, and he has no grace nor beauty to redeem his reputation. He digs a small, deep hole in the ground, and stations himself at its mouth, ready for victims. When one





FIG. 132.

I. COMMON TIGER-BRETLE.

Cicindela vulgaris.

2. SIX-SPOTTED
TIGER-BEETLE.

Cicindela sexgutata.

travels within his reach, he seizes it and drags it down to the bottom of the hole, where his dining-room is. Lest the insect should prove too much for him, and should drag him out instead of his dragging it in, the larva is provided with a little hump on his back, on which are two strong hooks pointing forward. These he hooks into the ground and anchors himself so that even a large insect cannot pull him loose.

There are over sixty species of North American tiger-beetles.

#### FAMILY SIL'PHIDÆ

The habits of these beetles have earned for them the name of Carrion-beetles. You will find them in numbers about dead birds or other small animals, running and digging and pushing, all as busy as the busiest bee you ever saw.

The beetles found in such places will not all



FIG. 133. CARRION-BEETLE. Silpha inæqua

be of the same species. Some will be small and flattish in shape, with thin, projecting edges to the thorax, and of a brownish-black colour, except the front part of the thorax, which is a washed-out yellow. They do not bury the dead animal, but work under and in it; it serves

them for food and for a place to lay their eggs. Other beetles will be of medium size, black, with red or yellow marks. These are buryingbeetles, called also sexton-beetles, and gravediggers. They plough around the dead body with their heads, digging the soil out from under it, and letting it gradually down into a grave. Then they cover it up, and when it is arranged to their satisfaction, the female digs down to it again, lays her eggs in or on it, and departs for good. If the body happens to be

lying on a rock, or in any place where digging is not possible, the beetles will push and pull till they have it where they want it.

Other beetles of this genus are large, round-bodied, dark-brown fellows, with two dull red spots on each elytron. The spots are irregular in shape, and look like two or more spots run together. The anten-



FIG. 134.
BURYING-BEETLE.
Necrophorus americanus.

næ have knobs at the end, as do those of nearly all beetles of the family *Silphida*.

## FAMILY ELATER'IDÆ

The wire-worm is one of the worst enemies of the farmer. It is familiar to everyone who

has ever tried to raise anything in field, garden, or flower-bed, a slender, hard, smooth, yellow-brown "worm," that feeds on almost any kind of plant, working at the roots, or at the seeds before the roots have started, and, when occurring in great numbers, doing a vast amount of harm. I doubt, however, if many people know that the wire-worm, when fully developed, becomes the insect known as clickbeetle, snapping-beetle, spring-beetle, skip-jack, and el'ater. Most of these names are given on account of its habit of springing into the air, when laid on its back, with an audible click, coming down generally on its feet. It is able to do this because two segments of the thorax are very loosely joined, and it has a spine or horn on the under side of the thorax that acts as a spring.

This is a common and attractive species. It is a large, clean-looking beetle, black in colour, but well sprinkled above and below with pale straw-yellow in dots and points. On the thorax are two oval, velvety black spots, each with a narrow line of straw colour round it. These spots look so much like great eyes that it is hard to imagine them anything else. The antennæ are short

and slender for the size of the beetle. The

larvæ of this species are not so injurious as some. They are found in decaying wood, being partial to apple trees.

There is another slender, plain brown, little click-beetle that is very common in summer, appearing in the house at night, on tables and window-sills, but I do not know his name.



FIG. 135. EYED ELATER.
VELVET-SPOTTED SPRINGBEETLE.
Alaus oculaius.

There are over five hundred species of clickbeetles in North America.

#### FAMILY LUCAN'IDÆ

The name of Stag-beetle, or Stag-horn, is given to this family because of the branching mandibles possessed by some species. The following species you will probably collect first.

It may sometimes be mistaken for a Maybeetle, because it makes a great buzzing as it flies, and often comes into a lighted room at night. It is plain dark brown, broad, and thick-bodied. The mandibles of the male are longer than those of

the female. The grub is a fat, yellowish-white creature. You will often find it in decayed trees or stumps, oak, apple, and some others.



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FIG. 136.
COMMON STAG-BEETLE,
Lucanus dama.



FIG. 137.
HORNED PASSALUS.
HORN-BUG,
Passalus cornutus.

This is another stag-beetle, not as common as the last, but interesting because it has a short, stiff horn, pointing forward, on the top of its head, as no other stag-beetle has. It is large and very black and shining, and is found in decaying wood on which the larvæ feed. It is sometimes called the Horn-bug.

## FAMILY SCARABÆ'IDÆ

This family is divided into two groups, the Scavengers and the Leaf-chafers.

To the Scavengers belong the common

"tumble-bugs" met often by the roadside, two together, rolling along a ball of cow-dung much larger than both of them combined. They generally go a long way before they are satis-

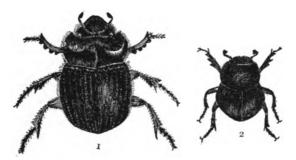


FIG. 138. TUMBLE-BUGS. DUNG-BEETLES.

1. Carolina Tumble-bug.

Copris carolina.

2. Common Tumble-bug.

2. Common Tumble-bug. Canthon lavis.

fied to stop, then they bury the ball and the female lays her eggs in it. They are believed to roll these balls to a distance that the larvæ may be safe from the carnivorous insects which visit masses of dung to feed upon the larvæ they contain.

Most "tumble-bugs" are black, but there is one common species that is very handsome. It is a short, thick beetle, with bright green wing-covers and a brilliant red-bronze thorax. The thorax is rough, and the wing-covers have slight ridges running lengthwise. The male has a large horn on the head. This species has no popular name; its scientific name is *Phanæ'us car'nifex*.



FIG. 139. TUMBLE-BUG.

Phaneus carnifex.



FIG. 140. SKIN-BERTLE. Trox monachus.

Other members of the Scavenger group are the Apho'dian Dung-beetles, small beetles frequenting the droppings of cattle and horses in pastures, one species, with black body and bright red elytra, being common in woods where cattle run; the Earth-boring Dungbeetles, that bury balls of dung in holes in the ground, and lay their eggs in them; and the Skin-beetles, that live on dried, decaying animal substances, and are always crusted with dirt which is very hard to scrape off.

The Leaf-chafers live on leaves and flowers. They include Rose-bugs, or Rose-chafers, whom we all know and dislike; May-beetles, also called June-bugs and Dor-bugs; the Shin-

ing Leaf-chafers, most of which are extremely beautiful; the Rhinoceros-beetles, many of them furnished with a horn on the front of the head, and sometimes one or more on the thorax besides; and the Flower-beetles, frequenting flowers.

You will often find this beetle on grapevines, the leaves of which are his food. I



FIG. 141.
SPOTTED PELIDNOTA.
Pelidnota punctata.

found one once on a milkweed leaf, but Spotted Pelithoo'ta. it was near a tree overgrown by a grapevine, and I think he had dropped from it, or was on a journey somewhere. He is a light mahogany brown, with three small, round, black spots on the outer

edge of each wing-cover, and one at each edge



FIG. 142.
GOLDSMITH-BEETLE.
Cotalpa lanigera.
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of the thorax. Underneath he is bronze-green. Look for him among the vines in July and August.

The name gives no idea of the beauty of this beetle. It is about Goldsmithbeetle. The wing-covers are golden yellow

with a brilliant lustre, and underneath it is metallic green, covered with a white woolly fuzz. It is common in the eastern United States, in early summer, feeding on the leaves of various trees. The grubs are said to destroy the roots of strawberry plants.

The last two beetles belong to the Shining Leaf-chafers.

This is the largest of North American bee-

has a Dynas tes large tit/yrus. horn on the head. pointing forward, and another on the thorax. The two are about equal in length, and curve slightly toward each other, almost meeting at the tips. There are also two small

tles. The male

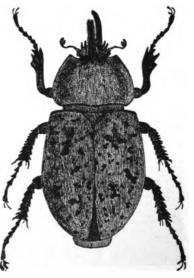


FIG. 143. SPOTTED HORN-BEETLE; MALE.
Female smaller, and without horns.

Dynastes tityrus.

horns on the thorax. The female has no

horns, only a knob on her head. The beetle, when first transformed from the pupa, is plain dark brown, but changes later to greenish-grey, much marked on the elytra with black spots of various sizes. Both beetle and larva have an extremely bad odour. They live in decayed stumps and logs. This species is found only in the South, where it is called Spotted Hornbeetle.

Another species, much like the preceding, but with a longer horn on the thorax, is found in the West; and still another, the Hercules-beetle, lives in the West Indies. The latter is the largest true insect known in the world. The horn on its head is three inches long, as long as the rest of its body. The thoracic horn is considerably shorter, and the beetle looks, it has been said, like a pair of pincers with the body for a handle. It belongs, as you will guess, to the Rhinoceros-beetles.

This is the commonest of its group, and is so called because it makes a loud humming as it flies, like a bumble-bee. It flies
close to the ground, and appears
very early in the spring, and again
in the early fall, there being two broods. It is yellow-brown, with little black dots all over

the surface. The elytra have each a large notch near the base. The beetle feeds on pollen, and various fruit juices. It is also at-

tracted by sap running from trees in spring.



FIG. 144. BUMBLE FLOWER-BEETLE. INDIAN CETONIA. Euphoria inda.



FIG. 145. HERMIT FLOWER-BEETLE. Osmoderma eremicola.

This is a shining, dark red-brown beetle,

Hermit
Flowerbeetle.

This is a shining, dark red-brown beetle,
more than an inch long. It is considerably larger than the Bumble
Flower-beetle, and has no notches
on the sides of its wing-covers.

# FAMILY BUPRES'TIDÆ

This is another beetle without a popular name. It is nearly an inch long, highly polished, of a copper colour, and the elytra are marked with raised black spots, square or oblong in shape, and many irregular sunken lines between them.

The wing-covers are very tapering, and separate a trifle at the tips. The larvæ are borers in various fruit and shade trees.



FIG. 146.
DIVARICATED
BUPRESTID.
Dicerca divaricata.



FIG. 147. VIRGINIAN BUPRESTID. Chalcophora virginica.

The larva, like most of the Buprestids, is a borer, the family being known as Wood-borers. This one works in pine, often doing much damage. The beetle is large, of a dark coppery colour, and is very rough, with crooked ridges running lengthwise of the wing-covers. It flies in early summer among the pine trees.

### FAMILY CARABIDÆ

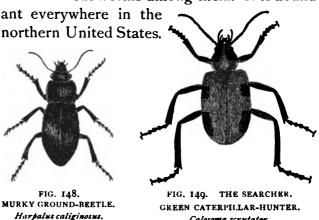
These beetles are generally, though not always, black, and they have long legs with which they chase and capture other insects for food. They, of course, live on the ground, and are therefore called Ground-beetles. Some of

# Insect Friends and Foes

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them have no hind wings. They hide by day on the ground, or under the bark of trees, and hunt only at night. The black species are the most common, but a few are bright-coloured, and some have small spots on the wing-covers. Nearly every species has the wing-covers marked with ridges. The larvæ are found under stones or grass or bark.

This is a common and very black beetle, about an inch long, hiding under stones or scampering about in the grass. Murky feeds on the larvæ of other insects. Groundbeetle. cut-worms among them. It is abund-



Of the coloured ground-beetles this is one of the largest and gayest. It has bright green

Calosoma scrutator.

elytra, and is variously marked with red, green, gold, blue, and violet. It generally lies in wait for its prey in little holes in the The ground, but will sometimes climb a Searcher. tree to hunt for caterpillars, especially for canker-worms.

This beetle is quite common. It is black and rough, and its elytra are decked with copper-red dots arranged in lengthwise rows. The Fiery It is not so large as the Searcher,



FIG. 150.

FIERY HUNTER.

COPPER-SPOTTED CALOSOMA.

Calosoma calidum.

but is of the same shape. It will also ascend trees for caterpillars.



FIG. 151.

BOMBARDIERBEETLE.

Brackins stygi-

To the same family belong the beetles known as Bombardiers, which squirt an acrid, ill-smelling fluid into the face of their pursuers. This fluid is secreted in a little sac at the hind end of the body. The beetles are reddish yellow, with blue, green, or dull black wing-covers.

#### FAMILY LAMPYR'IDÆ

These are the Fire-flies. They are flat, thinbodied beetles, and the edge of the thorax projects on either side, and sometimes extends over the head. The real fire-flies are nightfliers, and their "fire," a soft, greenish phosphorescence, is situated under the abdomen. Their colour is pale yellow and rusty black. Great numbers of them appear in summer evenings, darting like flash-lights over meadows and lowlands. These beetles are also called Lightning-bugs, but incorrectly, for you will remember that a beetle is not a bug.

One species of fire-fly, native to South America and the West Indies, has two transparent oval spots on the thorax, out of which shines a light so bright that fine print can be read by it, and several of these beetles, shut up together, give light enough to write by.

This is a long, slender beetle, with a black spot on a yellow Pennsylvania thorax, and a long, narrow black spot on each Soldierbeetle. yellow wing-cover. The antennæ project straight forward for a very short distance, and SOLDIER-BEETLE. then spread out in a broad curve.



PENNSYLVANIA Chauliognathus pennsylvanicus,

It flies by day, and frequents goldenrod and other flowers that bloom late in the season.

### FAMILY DYTIS'CIDÆ

These beetles live in still, fresh water. They are known as Diving-beetles, or Water-tigers.

The spiracles, which you recollect are the open ends of the airtubes through which they breathe, are at the end of the abdomen, under the wing-covers. When the beetle is quiet he hangs at the surface of the water, with his head down and the end of his abdomen out of water just far enough to let him draw air into the

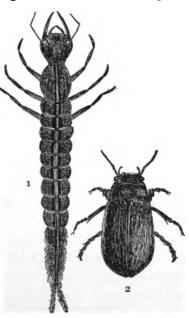


FIG. 153.

1. WATER-TIGER, LARVA OF DYTISCUS.

2. DIVING-BEETLE.

Dytiscus.

spiracles. When he wishes to swim about, or to dive after his prey, he raises his wing-

covers and shuts a little air under them, which lasts him for some time; and when it is used up he comes to the surface for more.

These beetles are fine swimmers. They have long, flattened hind legs, fringed with hair, and flat, thin bodies which slip easily through the water. They can also fly well. Their colour is dusty black, sometimes marked with yellow. They are predaceous and very fierce. Some will even attack small fish. I have several times tried to keep large ones in an aquarium, but they ate up the little frogs and tadpoles without mercy till I would not sacrifice any more.

The larvæ well deserve to be called Watertigers. They have long bodies, flat heads, and formidable jaws. The mandibles are hollow, and have a hole near the end, so that as they crush their prey the juice runs into the hole and through the mandible to the digestive apparatus.

### FAMILY HYDROPHIL'IDÆ

These are flat, black beetles, looking much like the Divers, but the palpi and antennæ are different. They have a silvery look, such as the leaves of the garden columbine and some other plants have when held under water. This appearance, in the beetle, is caused by a thin layer of air on the under side of the body,

which the beetle carries from the surface of the water in his folded antennæ. These beetles are called Water-scavengers because they clear the water of decaying vegetation by eating it up, but several species will eat insects, and the larvæ of all species are carnivorous; some of them are cannibals, and devour their brothers and sisters



FIG. 154.

WATER-SCAVENGER.

Hydrophilus triangularis.

even before they leave the egg-sac in which they were born. The beetles live in still water, and may be taken by sweeping with a dip-net the plants that grow at the bottom.

Their manner of caring for their eggs is an interesting study. The female secretes a substance like silk which hardens and becomes entirely waterproof. From this material she makes a case in which she deposits her eggs, and here they remain until the larvæ hatch, when those that have escaped being eaten by some other member of the family crawl out, and proceed to earn their own living. The

egg-sacs of some species are carried about by the female on the under side of her body, held in place by her hind legs. Those of other species may be found floating about in the water, and others attached to the lower surface of the leaves of water-plants.

#### FAMILY GYRIN'IDÆ

These are the Whirligigs. Every country child knows them well; flattish, oval, bronze or blue-black beetles, of medium size, with very long fore legs, and the other two pairs broad and flat for swimming, and so short



FIG. 155. WHIRLIGIG.

that they look like mere fragments of legs. They have wings, also, and can fly from one pool to another. Their eyes are very curious, being situated on the exact edge of the head at either side, having the effect of two pairs of eyes, one looking down and one up. Their

food is little insects that fall within their reach. You will see these beetles in crowds on the surface of ponds, or of pools in streams, lying so still that you are sure you might dip up a dozen at once, and darting off like shadows if you make a movement toward them. If pushed too hard they will dive, but they love the sur-

face best, and their lively motions, circling about each other and zigzagging here and there, have earned for them the popular name of Whirligigs. If you succeed in catching one he will show his displeasure by giving out an unpleasant milky fluid.

#### FAMILY PTIN'IDÆ

The only member of this family which will have especial interest for a young naturalist is the beetle known as the Death-watch or Death-tick. It is a small insect, brownish in colour, but you will be more likely to hear it than to see it. It bores into old wood, and it makes a queer ticking noise which superstitious people think is a sign that somebody who hears it is going to die. It is nothing, however, but the call of one beetle to another, and he makes it by standing on his hind legs and knocking his head and thorax hard on the wood. The insects are numerous in old houses.

# FAMILY DERMES'TIDÆ

These are small beetles with a large capacity for mischief. They are generally grey or brown, or both, and they have a family trait of turning on their backs when caught and pretending they are dead. Among them is 206

Mr. Anthrenus, more correctly the Messrs. Anthrenus, there being three species; one of them known as the Carpet-beetle, or Buffalobug or moth (though it is neither a bug nor a moth), from the short, thick, dark brown hair on the body of the larva. It is the larvæ of all these beetles that do the mischief to carpets and clothes.

Another species is the tiny white worm which is often found inside of raspberries.

#### FAMILY COCCINEL'LIDÆ

The Lady-bugs, or Lady-birds, are as useful as the Dermestids are harmful, for they eat

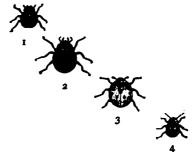


FIG. 156. LADY-BIRDS.

- Plain or Trim Lady-bird. Coccinella munda.
- 2. Two-spotted Lady-bird. Adalia bipunctata.
- Nine-spotted Lady-bird. Coccinella novemnotata.
  - 4. Painted Lady-bird.

    Harmonia picta.

small insects as well as the eggs of insects too large to be eaten. They are often found on

house-plants, where their presence is most desirable, because they feed on plant lice. A species imported from Australia is the greatest friend of California fruit-growers, by destroying a pest called the Cottony Cushion-scale, which nothing else has been able to control.

Our common Lady-bug is a reddish beetle with three black spots. Some species are red or yellow with black spots, and some are black with red, or yellow, or white spots. The number of spots varies in different species from two to fifteen. The eggs are yellow, and are often laid in the midst of a colony of plant lice, on which the larvæ feed when hatched.

The larvæ are ugly-looking, lively little creatures, found on leaves, and, like the adults, are generally carnivorous.

# FAMILY STAPHYLIN'IDÆ

The members of this family are characterised by very short wing-covers and very flexible abdomens. The elytra look as if

they had been cut off, and the beetle often has difficulty in making them cover his wings, which are of quite full size. The Rove-beetles, as they are called, cannot sting, but they pretend they can, and will turn



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the abdomen up as a wasp does, when angry. One large species in England is called, from this habit, Cocktail, and Devil's Coach-horse. These beetles are scavengers, eating decaying matter of various kinds. You will find them in wet places, under stones, moss, leaves, and trash on the ground. Their colour is generally grey, or black, or brown, sometimes with a little yellow.

### FAMILY CHRYSOMEL'IDÆ

The Chrysome'lids are all leaf-eaters. Among them are the Colorado Potato-beetle, or Potato-bug; the Asparagus-beetle; the "Striped-bugs" that destroy our cucumber, squash, and melon



TORTOISE-BEETLES.

Black-legged Tortoise-beetle.
 Cassida nigripes.
 Golden Tortoise-beetle.
 Coptocycla aurichaltea.

leaves; certain tiny mischief-makers called Fleabeetles, from their small size and great activity; and others, not so injurious, known as Tortoisebeetles, from their flat, rounded shape. One of

these is quite common on milkweed. It is less than half an inch long, a rusty red, much spotted with black. From these spots, like eyes, it is called the Argus-tortoise. The larva is flat and fringed with hairs, or spines, two of which at the end of the body spread apart like a fork. On these the creature carries its castoff skin after moulting, bending the tip of the abdomen up and forward so as to bring its strange parasol over the body, for protection. You will find larvæ, pupæ, and beetles, all at the same time, on milkweed, in midsummer.

This is another tortoise-beetle, feeding on morning-glory leaves. It is much smaller than the Argus. In shape it is almost as broad as long, very thin at the edges, and having the front segment of the thorax extended so far that it quite conceals the head. The colour is yellow. The larva has the same queer habit as the Argus; indeed, it is characteristic of all the tortoise-beetle larvæ.

### FAMILY TENEBRION'IDÆ

These are called Darkling-beetles, perhaps because they are nearly always black. Not many species are found in our country, except in the Southwest.

This species lives on toadstools, the large ones that grow like shelves on the trunks of trees, and it has two forked Fungus-beetle. horns, rough and club-shaped, on the thorax. It is dull black in colour, and the whole

# Insect Friends and Foes

body surface is rough with little knobs. You may look for it in August, and you will be quite sure to find not only the beetle, but the dark brown larva also.



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FIG. 159. FORKED FUNGUS-BEETLE. Boletotherus bi furcus.



The larva is a hard, smooth, round-bodied, yellow worm about an inch long, found in meal and flour. The beetle is black. Like the larva it feeds on flour and meal, and is a very common pest in mills and about bins where grain is stored. It is often called Meal-beetle, or Flour-beetle.

Some species of the Darkling-beetles have no wings, and the elytra are grown together into a rounded cover for the abdomen.

### FAMILY MELO'IDÆ

The Blister-beetles take their name from a poison contained in their bodies, which blisters the skin when applied to it. The species most commonly used for this purpose is not native to this country but to Europe, and is

called the Spanish-fly. Its colour is a lustrous green. The paste of which the blister-plasters are made is composed of the dried and powdered bodies of the beetles. This family differs from all other insect families in having several changes of form while in the larval state. There are very many species.



FIG. 161. ASH-COLOURED BLISTER-BRETLE: MALE. Female has but one

long segment at base of antennæ.

Epicanta cinerea.



FIG. 162. BUTTER-CUP OIL-BEETLE. Meloe angusticollis.

This is an ash-grey beetle about half an inch long. covered with very soft, Ashfine hairs, almost as coloured soft and short as the Blisterbeetle. down on a peach.

Like others of its genus it feeds on potato leaves and goldenrod pollen. There is a variety of this species called the Margined Blister-beetle, because its elytra are black with a grey margin.

This species is a large, dark blue beetle, that feeds on buttercup leaves. Its wing-Buttercup covers are as short as Oil-beetle. those of the Rove-beetles, and overlap a little at the base. It has no wings at all. The body is soft and looks as if it were swollen. If you dis-

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turb the beetle too much, it gives out from the joints of the abdomen a yellow, oily-looking fluid, from which it takes its name. The larvæ are parasites, living on the bodies of bees.

There are many other species of Oil-beetles, composing one genus of the Blister-beetle family.

### SNOUT-BEETLES

#### FAMILY CURCULION'IDÆ

There are many species, all very injurious.

They bore holes in apples and Curcu'lios. garden fruits, cranberries, nuts, acorns, Weevils. seeds, and the bark of trees, especially pine and oak. They often destroy a whole crop of fruit. You may recognise the work of a curculio on a plum or a peach by the small, hardened, gummy kernels on the surface, surrounding a tiny hole out of which the gum first oozed. Sometimes there are several FIG. 163. holes. The female makes the hole with her snout, then she





FIG. 163. WEEVILS.

1. White-pine Weevil.

Pissodes strobi.

2. Nut-weevil.

Balaninus rectus.

lays an egg in it, and then uses her snout again to push the egg to the bottom of the hole.

#### FAMILY CALAN'DRIDÆ

These are common beetles, having a slender snout much shorter than that of a curculio. The larger species bore in the stems

Bill-bugs. of plants or the trunks of trees, and the small attack seeds, as wheat and rice. Some are black and others brown. They are called weevils, but have some points of struc-

ture different from the last family.

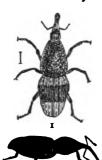


FIG. 164. BILL-BUGS. z. Rice-weevil. Calandra oryza. 2. Sphenophorus pulchel-

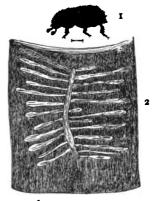


FIG. 165. ENGRAVER-BERTLE. WOOD-ENGRAVER.

Xyleborus cælatus.

1. Beetle, about four times life-size. 2. Work in cambium layer of pine

#### FAMILY SCOLYT'IDÆ

These are named from the engraving they do under the bark of trees. You Engraverwill find specimens of it by stripbeetles. ping the loose bark from the standing trees,

# Insect Friends and Foes

from stumps, or from logs in the wood-pile. Different species have different patterns of engraving. They are all small, some almost too small to be seen without a microscope, and are brown or black.

There are several other families of Snoutbeetles, but all are small and in no way notable except for the mischief done by some of them.





### ORDER HEMIP'TERA

(HALF-WINGS)

THIS order is divided into three sub-orders, the True Bugs, the Parasites, and a third called Homop'tera.

The True Bugs comprise twenty-six families. They have four wings, the hind pair are membranous, and when not in flight are folded under the fore wings, which are thickened toward the body and suggest the elytra of beetles. The mouth consists of a fleshy, jointed beak, formed for piercing and sucking. There is no larval nor pupal state, the young being called nymphs.

Parasites have no wings. They live on the bodies of men and animals, and are called Lice. There is but one family of Parasites, comprising several species.

The Homoptera includes nine families of insects which are alike in the position of the beak, and in having wings of uniform thickness throughout, if they have wings at all, but otherwise they are about as diverse as any nine families of insects could well be.

Bugs are generally small insects as compared with beetles, and many families are so much alike in looks that you will find it True Bugs. difficult to distinguish between them until you take up the study of their wing-covers, antennæ, tarsi, etc. Instead, therefore, of naming many species, I will give you the characteristics of the commonest and most easily identified.

#### FAMILY PENTATOM'IDÆ

No bug is better known to those of us who have lived in the country than that known by stink-bug. this inelegant but fitting name. Not only has the bug himself a disgust-

ing odour, but he leaves it behind him wherever he travels, and he travels generally over the finest berries. Often you will find him still at the feast, a shield-shaped brown or green bug, with slender, five-jointed antennæ. His bad odour is his defence against his



FIG. 166. STINK-BUG.

enemies, for they soon find out that he is not good to eat.

There are many species of this family, and some are our friends because they destroy noxious insects.

#### FAMILY CORE'IDÆ

To this family belongs another ill-smelling insect, the Squash-bug, but his odour is not

so evident until he is crushed. He does great mischief to squashvines. You will find the roundish, amber-coloured eggs, like small seeds, in patches on the under side of the leaves, and you will probably find at the same time the adult insect, a dull black bug, yellowish



FIG. 167. SQUASH-BUG.

underneath, and with a little yellow on the sides of the body. Squash-bugs live all winter. I have often found one in snug quarters in the house in midwinter.

# FAMILY NAB'IDÆ

These bugs are shaped a little like the Indian clubs used in calisthenics, the head for the handle and the round body for the club part. The Comstock Manual calls them Damsel-bugs, from the English meaning of the Latin name of one genus.

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This is one of the commonest species of the

It is black and shiny, and genus. has yellow legs and a vellowish edge to the sel-bug. abdomen. It lives on small insects which it overtakes by using its legs, for its wings are so short that it cannot fly. You will find it in gardens hiding among flowers and leaves.



BLACK DAMSEL-BUG. Coriscus subcoleoptratus.

#### FAMILY REDUVI'IDÆ

This family has various names, suited to its character—Assassins, Pirates, Corsairs, and Blood-suckers. They are fierce, fearless bugs, living on insects, whose blood they suck, and

sometimes attacking the higher animals, and even human beings. They have long beaks with which they can inflict painful wounds, so you must handle them carefully.

One species is often found in houses, and even in beds, where it is supposed to be looking Masked Bed-for bed-bugs. It is covbug Hunter. ered when young with a sticky substance which attaches to it all the lint

and loose dirt it is able to carry, so that you would never guess what sort of creature it was. From its habits it receives its name. When it is full grown it no longer wears its mask of dirt, and shows itself to be a black bug, with hairy legs and a short, stout beak.

This is a southern species, also frequenting houses. It is named from a round Two-spotted spot on each wing-cover. Corsair.



FIG. 170. BLOOD-SUCKING CONE-NOSE. BIG BED-BUG. Conorhinus sanguisugus.

Another common species is named in allusion to the shape of its beak.

It is widely distributed, and it Cone-nose. is said to enter beds and suck human blood. Its bite is very painful.

Still another species, of a yellow-brown colour with dark rings on its legs, has a Latin name meaning something like banded robber. It has the reputation of destroying the larvæ of the Potato-beetle.

For all the hard names we give them, however, the *Reduvi'idæ* are, on the whole, our friends, because they destroy other insects

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which are harmful to vegetation, and even to human beings.

#### FAMILY EMES'IDÆ

The members of this family consist largely of legs, long, slim legs, with the middle joint high in the air, so that the slender brown body hangs from them as if in a frame. The front pair help the bug to hold his prey, which consists of insects. The bugs are called Thread-legged.

This is our commonest species. Like most of the family, it is brown, but it has a white

Long-legged with a brown line below the eyes, and brown and white rings on its thighs. It is called Spi-



FIG. 171. LONG-LEGGED EMESA.

Emesa longipes.

der-bug, Stick-bug, Walking-stick, Spectre, Race-horse, Wood-horse, Prairie Alligator, and half a dozen other names. It has a large appetite, though to look at its thread-like body you can not help wondering where it finds storage for its food.

#### FAMILY BERYT'IDÆ

These bugs, called Stilt-bugs, look a little like the last family. They have a slender body, legs, and antennæ, and the antennæ are enlarged at the end. The hind legs are much longer than the others. The insects live among bushes and grass, where they find their prey, but they

are not nearly so fierce nor so nimble as the *Emes'idæ*.



FIG. 172. STILT-BUG. Yalysus spinosus.

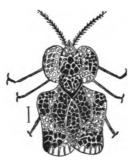


FIG. 173. LACE-BUG.

HAWTHORN TINGIS.

Corythuca arcuata.

Other families of bugs, either of small size, or not easily identified by a beginner, are the Negro-bugs, so called because they are generally black; Flat-bugs, as flat and thin as if you had pressed them in a book; Red-bugs, generally marked with red on a black or brown ground; Lace-bugs, covered with a dainty,

snow-white net; Shield-backed bugs, named from their shape; Burrowing-bugs that bur-



FIG. 174.

AMBUSH-BUG.

Phymata wolfii.

row in the ground; Ambush-bugs that hide in flowers and spring out after insects which come after honey; and Chinch-bugs, whose name is given from the best-known and worst-hated member of the

family, which has caused losses amounting to many millions of dollars in the grain-growing parts of our country.

There are also many families that live in or near the water.

### FAMILY LIMNOBAT'IDÆ

The only species yet found in this country

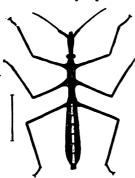


FIG. 175. MARSH-TREADER.

Limnobates lineata.

is the Marsh-treader. Its food is not known, but it lives in marshes or about marshy pools. It can run on the surface of the water, but it makes very little stir in the world, and is not often noticed. It is not unlike the stilt-bugs, but its legs are not quite so slender, nor its

antennæ so long, and its head is much larger.

It has no hind wings. It is not more than half an inch long.

#### FAMILY HYDROBAT'IDÆ

These are often called "skippers" by country children. They have immensely long hind and middle legs, and very short fore legs, and

they live in swarms on the surface of the water, either lying perfectly still, or shooting about with great swiftness, their motions much resembling those of the whirligig beetles. They

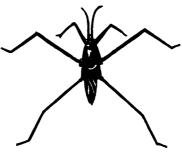


FIG. 176. WATER-STRIDER.

Hygrotrechus conformis.

eat insects, which they easily capture by their agility, sometimes springing into the air after them. They spend the winter hidden somewhere under water, and appear very early in the spring. They have a coat of thick, short hairs on the under side of the body, which water does not penetrate. They are known as Water-striders.

# FAMILY BELOSTOM'IDÆ

These are the largest true bugs known. They are fierce and greedy, and will even

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attack and devour little fish. They have round, bulging eyes, broad, flat bodies, power-

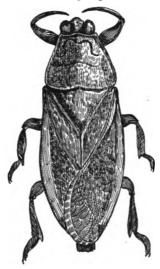


FIG. 177. GIANT WATER-BUG.

Belostoma americanum.

ful and rather short legs, overlapping wingcovers, and strong wings with which they fly from one body of water to another. They are said to fly by hundreds into the deadly electric lights. The eggs are laid in a mass, about a hundred in number, on some object near but not in the water. young are pale green when first hatched, but soon turn grey like their

mother. These bugs are called Giant Waterbugs. The largest species is found in South America, and is more than four inches long, while some of our own species are nearly as large.

# FAMILY NAUCOR'IDÆ

This is another family of water-bugs much smaller than the last. They have short legs with which they can swim or walk, and the front pair is fitted for seizing their prey. Their bodies are flat and squarely built, not pointed

at the ends, like the Giants. They are called Creeping Water-bugs, because, instead of swimming boldly about over the open water after insects, they creep among the grass and water-plants growing in still pools, and seize whatever comes



FIG. 178.

CREEPING

WATER-BUG.

Pelocoris femorata.

within their reach. Only one species is found in the eastern States.

### FAMILY CORIS'IDÆ

These bugs have bodies somewhat like a boat in outline, pointed at one end and rather

square across the other. They are nearly half an inch long, and in colour a dark, uneven grey. The hind legs are broad, like oar-blades, and all the legs are edged with bristly hairs, but the body is smooth. The beak is short, and is



FIG. 179. WATER-BOATMAN, OR WATER-CICADA. Corisa undulata.

bent down and back. The insect is almost covered with a thin coating of air, like the beetles called Water-scavengers, which gives

# Insect Friends and Foes.

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him a silvery look. This air is what he breathes, and he can breathe it over and over because it is purified by the oxygen in the water. When he is at rest he clings by his fore legs to something under the water, and keeps his hind legs in motion so as to make a slight current about himself. He is obliged to cling to something if he wishes to stay under water, because his coat of air is like a cork jacket, and brings him up if he lets go. These insects prefer the bottom of ponds and streams, but they sometimes float. They are able to fly well, but cannot walk easily. Their food is insects. The family name is Water-boatmen.

### FAMILY NOTONEC'TIDÆ

These are called Back-swimmers, because they always swim on their backs, and propel



themselves through the water with their long, hair-fringed hind legs. They are also known as Boat-flies, and Boatinsects. The back

is shaped like a boat, and the under side is flat, which is just the opposite of the Water-boatmen. The spiracles are under the wings; and the insects, when floating on the water, admit the air to their breathing holes by keeping the tip of the abdomen raised. When they dive they carry air along, under their wings. well to handle them respectfully, for they can give ugly stings with their beaks. They feed on other insects.

#### FAMILY GALGU'LIDÆ

These bugs have bulging eyes and short, thick bodies, and there is something about the way they crook their fore and hind legs that reminds one strongly of a toad. They have therefore received the name of Toad-shaped bugs. Their colour is dark, sometimes black. They live in muddy places near Galgulus oculatus.

FIG. 181.

TOAD-SHAPED

water, and are said to burrow sometimes in the damp sand. They are carnivorous.





### SUB-ORDER HOMOP'TERA

### FAMILY APHID'IDÆ

THESE are the Plant-lice, some with wings and some without, small, soft bugs, that infest certain plants both indoors and out. An interesting thing about them is the power possessed by many species of giving out a sweet, glistening, sticky fluid called honeydew. Wasps, bees, and ants eat this honey-Some aphids are soft, green bugs such as we find on our house-plants. Various fruit trees have each its particular species. Some are covered with a white, waxy substance which they produce themselves, and are called Woolly Aphids. The common alder that grows by roadsides and water-courses is often infested by them; and another species attacks the beech. Others make galls on the elm. Aphids are the most numerous family of the Homoptera.

# FAMILY COC'CIDÆ

These are Scale-bugs, Mealy-bugs, and vari-

ous other pests which you will not care to collect or study at present.

#### FAMILY MEMBRAC'IDÆ

These are the comical, little, pale green Tree-hoppers. They have an angular, humped,



FIG. 182. TREE-HOPPERS.

Membracidæ.

beechnut-shaped body, a flat or horned thorax, two antennæ, and round, bulging eyes, for all the world like brownies. They are famous hoppers, and they live generally on trees, doing, however, no damage worth complaining of.

### FAMILY CERCOPIDÆ

As you walk over the fields in the summertime you will often find the grass stems loaded



FIG. 183.
FROG-HOPPER.
FROTH- OR SPITTLE-INSECT.
Aphrophora quadrangularis.

with little balls of white froth or foam. If you investigate one of the balls you will discover its maker and owner, a small green or brownish insect, known as a Spittle-insect, or Frog-hopper. Sometimes you will find several in one ball. They feed on the juice of the grass, which passes

through their bodies and is converted into a house, within which they live and go through all their changes. They are found also on herbs and other plants.

### FAMILY CICAD'IDÆ

In the hottest part of the hot summer days you will hear a loud, sharp insect song which seems to fill the air and to come from nowhere in particular. Sometimes you can locate the creature in a thick tree, but you will not often see him. His song is so associated with dry,

hot days that it seems like the voice of a weather-prophet, and he comes as near the

truth as most weatherprophets. People often call him a locust, but he is not a locust; he does not even belong to the same order. He is the Dog-day Harvest-fly, or Lyreman, but you must remember that he is not a fly, but belongs to the order of bugs. He has a thick, short body, tapering suddenly to a sharp point, long fore wings



FIG. 184. DOG-DAY HARVEST-FLY; LYREMAN. Cicada tibicen.

and small hind wings, very prominent eyes, and antennæ like fine hairs and so short as hardly to be visible. The body is black above, and of a powdery whiteness below. The veins at the base and outer edge of the fore wings are green, and there are various green marks on the head and thorax.

This is much like the last species in shape and size, but it lives under the Periodical ground, in the nymph state, a long Cica'da. time, seventeen years in the northern States,

thirteen years at the South. During this period it clusters on the roots of trees, and feeds on the sap. Its adult life is only a few weeks. The eggs are laid in little gashes cut in twigs,



FIG. 185. PERIODICAL CICADA.
SEVENTEEN-YEAR LOCUST.
Cicada septendecim.

and as soon as the young are hatched they drop to the ground and burrow into it, to begin their long imprisonment. This insect is not a locust, but you will often hear him called the Seventeen-year Locust.





### ORDER HYMENOP'TERA

(MEMBRANE-WINGS)

THIS order is divided into two sub-orders, the Stingers and the Borers, comprising together thirty-four families. They have four gauzy wings, the front pair being the larger. Each hind wing is furnished with hooks along the front edge, which catch into a fold along the hind edge of the front wing, so that the wings of each side act as one. The mouth is fitted for biting, sucking, or lapping. The females are generally armed with a sting or saw at the end of the abdomen.

The larvæ are called maggots. In two families, the Saw-flies and the Horn-tails, they look and act much like caterpillars, but in the other families they have no legs, and can neither travel about nor take care of themselves. They stay in the place where they were born, and live on the food provided for them by the adult insect when the eggs were laid. Some make a cocoon and some do not.

#### **STINGERS**

#### FAMILY ANDREN'IDÆ

These are the Short-tongued bees. Many of them are miners, making burrows in the ground, often several inches deep. In one genus, Andre'na, each bee makes her own nest, consisting of a main tunnel with branches. The tunnel is sometimes over a foot deep. At the end of each branch is a cell having a glazed lining like the enamel on crockery. The bee fills the cell with food, lays an egg in it, and closes the cell. The food is always honey, or the pollen of flowers. Bees never provide anything else for their young. These mining-bees often live in villages, making their burrows near together, but each one keeping strictly to her own premises. The bee is about the size of a honey-bee.

In another genus, the tiniest bees you can imagine, sometimes only one one-hundredth of an inch long, several of them club together and make a tunnel into the ground, often into a bank of earth or sand, and then each bee makes her own private burrow, branching from this. None of the Short-tongued bees are social bees; each has its own home. They appear very early in spring.

#### FAMILY APIDÆ

The Long-tongued bees are divided into the Solitary, the Social, and Guest-bees.

This bee, with her strong jaws, bores a tunnel,

Large Carpenter-bee. divides it into
Boring-bee. cells less than
an inch long, by partitions
made of fine sawdust stuck
fast together with a fluid
from her own body. The
tunnel goes straight in for
a short distance, and then
turns and follows the grain
of the wood. The boring



FIG. 186. LARGE CARPENTER-BEE.

BORING-BEE.

Xylocopa virginica.

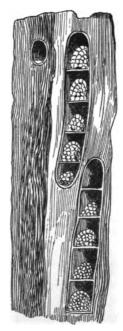


FIG. 187.
NEST OF CARPENTER-BEE,
OR BORING-BEE.

Xylocopa violacea.

A native of southern Europe.

may take several days. Each cell is supplied

with honey and pollen mixed into a paste, an egg is laid with it, and the cell is partitioned off. In the side of the lowest cell she gnaws a hole through to the outside, and fills it up again with paste. When the young bee is ready to fly, it eats its way out through the paste. The bee in the next cell above destroys the partition below him, and escapes by the same hole, and so on till all have flown. The mother gives them no help, for she leaves her nest when completed, and does not return. This carpenter-bee is about as large as a bumble-bee, and looks a little like one.

The nest of this bee is similar to the last, except that it is made in pithy stems which are easily worked, such as sumach, syringa, and blackberry, instead of in solid wood. The bee lays an egg and some food at the bottom of her tunnel, builds a floor above it, lays another egg and more food above that, builds another floor, and so on. She leaves a place for herself at the top, where she waits till all the larvæ have matured, and she and her children go out together, though they do not stay together long afterwards. The egg at the bottom of the nest, being laid first, hatches first; the little

new bee, when fully grown, tears down the ceiling of pith-chips, and waits till the bee in the second story is ready. The latter, in turn, tears down his ceiling, and waits for the next one above; and it is not long before the nest is deserted. Professor Comstock says that mother and children work together to clean out the nest, and one of the family uses it again. This bee is very small. It is a mineral blue-green in colour, and is one of the daintiest and neatest of insect workers.

This bee cuts round and oblong pieces out of leaves, rose-leaves preferred, to line her nest and to close the opening when com- Leaf-cutting pleted. She makes a cut as clean Bee. Tailorand smooth as if done by the finest and sharpest scissors. The nest is made in a tunnel bored in wood. She lines it with an oblong piece, puts in an egg and a supply of food, and closes it with a plug of round pieces. One of these bees which happened to come under observation, working for about twenty days, built thirty cells, arranged in nine rows; and cut and used about a thousand pieces of rose-leaf, besides collecting pollen for each cell, and depositing an egg in each. This bee has a stout body, a large head, and strong jaws.

Some species of the leaf-cutters do not make a tunnel, but use any suitable opening they find;



FIG. 188. LEAF-CUTTING BEE.

TAILOR-BEE.

Megachile brevis.

(After W. Saunders's "Insects Injurious to Fruits.")

and some use the petals of flowers instead of leaves.

Other solitary bees are miners, and burrow in the ground in dry, sunny places; others still are masons, and make their nests out of grains of sand glued together, or of clay, or mud. They provide each cell with an egg and some food, as do all the solitary bees. The mason-

bees are all small, the largest being only half an inch long. Their colour is generally a shining blue-green.

The Social bees live in colonies, made up of one queen, a few drones, and unnumbered workers. The queen has a slender body, and small wings which are used for flight only twice

in her lifetime. She also has a sting, but she never uses it except against another queen who might dispute her title. Her mission is to lay the eggs for the colony. The drones are all males. They have a short, broad body, and They no sting.







FIG. 189. HONEY-BEE,

Apis mellifica.

Queen. b. Drone, or Neuter.
c. Worker.

All slightly smaller than life-size.

stay pretty closely at home, but never do any work, and in the fall they are killed or driven out of the hive by the workers. The workers are females not fully developed. They never

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lay eggs, but they are the real "busy bees," doing all the work of the colony. They make the wax, build the cells, collect the honey to fill them, take care of the eggs, feed the young, and defend the hive from its The workers are the smallest bees enemies. in the colony, but they have strong wings, for they must fly far and often. They also have a sting which they use with great freedom. Large books have been written about the wise and curious ways of bees, and you will be well repaid for all the study you can give them. Our wild bee is the same species as the honeybee, escaped from captivity. It is a native of Asia.

This is our native bee. We all know it well, a large, hairy creature, dressed in black and Bumble-bee. gold, buzzing and blundering about among the field and garden blossoms. The nest is on the ground, sometimes in a burrow, sometimes in a ready-made hole, and often in the deserted nest of a ground-bird or a field-mouse. Like all social bees, the colony is made up of a queen, drones, and workers. You may think a bumble-bee is a bumble-bee, and always the same, but there are more than fifty species in North America.

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The Guest-bees, or Cuckoo-bees, are curious insects, neither male nor female doing any work, nor making the slightest provision for their young except by compelling some other bee to adopt them. They do this by stealing into the nest of another bee, and leaving an egg there. In some cases it hatches first, and the larva eats up the food provided for the rightful owner; in others, it is taken care of by its foster parents as if it were their own. Whether they do this cheerfully or not we cannot tell, nor why they consent to do it at all; neither is the mission of the Guest-bees yet determined.

### ANTS

The Ants, like the bees, are divided into males, females, and workers. The males and the females have wings, but the female pulls hers off when ready to lay her eggs. The workers have no wings, but stay at home and do the work, much like the bee workers. They wait on the queen, and take care of the larvæ, feeding and smoothing them, and carrying them about to the driest and warmest spots in the nest. Sometimes they lay them out in the sun, and then if rain or any danger threatens, there is a great scur-

rying to get the babies into the house. The little white oblong bodies which are often brought to light in turning over loose soil or decayed wood, are ant-cocoons. Ants, like bees and wasps, are fond of honey-dew, but only the ants seem to know where it comes from, and to be shrewd enough to cultivate the aphids' acquaintance. They carry them from place to place in search of food for them, and will even shelter their eggs in winter, and put the young aphids out on plants when spring comes. Ants are terrible fighters, and the workers, or soldiers, go out in great armies to wage war.

### FAMILY FORMIC'IDÆ

These are the ants that make the great mounds called ant-hills. They are curious fel-

lows, the abdomen being a shining black, and the head and thorax reddish. If you

FIG. 100.

dig into one of their mounds Formica exectoides. you will find it full of caves and galleries, out of which the owners will come tumbling, alarmed and angry at your intrusion. The outside is sometimes overgrown with scattered grass and weeds. It seems incredible that the

ants can build these mounds, as we know they do, grain by grain, for they are often reported six or more feet across.

The small, reddish-brown ant, that makes little hills with a hole in the middle, on sandy paths and roadsides, or in dry fields, Corn-louse is the Corn-louse ant, so called because it takes care of the aphids known as corn-lice, for the sake of their honeydew. The corn-lice live on the roots of grass and grain, one species being plentiful on cornroots. The ants dig their little burrows with their feet, throwing the soil behind them, and when they have gone too deep to throw it out, they make it into tiny balls and carry it out. When working in sand they take away one grain at a time. The mounds are built of the soil taken from the hole.

This is a very large black ant, the largest of our native species, and is common everywhere. It digs out a home for itself in the decaying wood of trees or buildings.

This ant looks almost exactly like the moundbuilder, but its habits are quite different. It

does not make a mound, but tunnels below the surface of the ground, sometimes under large Slave-holder. flat stones. It belongs to a group of ants that capture other species and make slaves of them. They go out in a long procession, and attack the nest of a certain small, dark-coloured ant, carrying off only the children, that is, the larvæ and pupæ. they treat kindly and bring them up in the way they wish them to go, and when the captives are grown they take a full share of the duties of the colony. A species of slave-holding ant, found in Europe, leaves all the work to the slaves, and has grown so lazy and helpless that it can no longer build its own home, nor even feed itself. A number of these ants were once removed from the nest, by way of experiment, and left to look out for themselves, and although there was plenty of food close by, they nearly all starved to death because they had no slaves to wait on them. A Slaveant was finally placed among them, and he at once provided a nest and food, and saved the lives of the remnant.

This is the species captured for slaves. It is smaller than the Slave-holder, and is dark in colour, black or brownish, with red legs. It

lives under stones. It is peaceable if left alone, but it does not lack courage, and it defends itself so bravely against its enemies that they are sometimes driven off and have to go home without any captives.

Slave-ant. Negro-ant.

#### FAMILY MYRMIC'IDÆ

This is the best-known species; a light, reddish-yellow ant, so small that it would scarcely be seen except that it often comes in great numbers to invade our cupboards and storerooms, in hot weather. The horde moves in a sort of procession, an irregular single file, and the members are exceedingly unwelcome guests. They are especially attracted by grease and sweets.

## WASPS

### FAMILY VES'PIDÆ

Wasps are social, solitary, or guests in the nests of other wasps. The Social wasps, like Social bees, have males, females, and workers. The queens and workers have stings, the males do not; they all have wings, and they look much alike, except that the queens are larger than the others.

Their food is insects, also sweets, fruit juices, and the honey-dew of aphids. They provision their nests with insects, not killed, but stung into insensibility. Social wasps are papermakers, and they use the paper sometimes for the material of the nest, and sometimes, when the nest is in the ground, for the lining. The paper is made of wood taken in tiny splinters from fences and buildings, chewed into a pulp, and pressed out into sheets with the feet. These wasps are often called Paperwasps.

Among our commonest and liveliest wasps are the Hornets, or Yellow-jackets. These are rather broad, short-waisted, black Hornet. insects, with yellowish rings and Yellowjacket. spots. They build large, grey paper nests, hung often under eaves of buildings, and oftener hidden in bushes in meadows and pastures. Their temper is hot and their stings are hotter. Farmers in the hay-field always give a wide berth to the clump of bushes where the Yellow-jackets have built, and the poor horses that draw the mowing-machine or the hay-wagon are sometimes terribly stung by the revengeful insects. Hornets belong to the genus Ves'pa.

This species is described by its name. In



FIG. 191. WHITE-FACED HORNET, AND NEST.

Vespa maculata.

point of temper it can claim but small advantage over the Yellow-jacket. It generally builds in trees a nest of grey White-faced Hornet. paper, which sometimes attains an immense size,

Another common wasp is larger than the

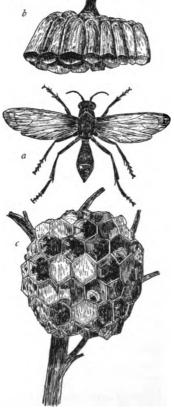


FIG. 192. a. SOCIAL WASP.

Polistes rubiginasus.
b. Nest of Polistes Rubiginosus.
c. Nest of Polistes.

hornet, brownish black, with vellow rings round the abdomen, which is long, and sharp at each end. The "stem," or peduncle, which joins the thorax and the abdomen, is longer than in the hornet. The nests are small. a single layer of cells, all crowded together, and hung by a stiff stem, like a nest begun and left unfinished. You will frequently find them attached to bushes in the fields, and also about buildings, on blinds or windows not often opened. These are the wasps that we find crawling feebly round on sills

and floors of our houses in early spring. They

are not so irritable as the hornets. The genus is called *Polis'tes*.

#### FAMILY EUMEN'IDÆ

This family are Solitary wasps, and they carry on the same trades as the Solitary bees, —mining, mason-work, and carpentry. The miners dig their nests in the ground, the masons work in mud and clay, and the carpenters bore in wood.

The miners dig a hole as a dog digs, using the jaws and fore feet, and flinging the soil back under their bodies. When they come to a small stone, they seize it in their jaws and drag it out of the way, or push it away with their heads. If they find a stone too large to be moved, they give the hole up and start another one. Their burrows are made in sand or loose soil, sometimes to the depth of several inches. They are called sand-wasps, but the name is not at all definite, because it is applied to other wasps not belonging to this family.

The mason-wasps build nests of mud, and fasten them to trees and walls, or use the mud for partitions in their cells. Some of them are carpenters as well as masons. These bore a hole in solid wood, or dig out the pith of brier, elder, sumach, and similar plants, or select a

cavity already made, sometimes choosing curious and inconvenient places. Mr. C. D. Gibson tells of a wasp that filled up most of the hollow bamboo handles in a lot of paint-brushes.

Professor Comstock one summer found the keyholes in his house,



FIG. 193.
POTTER- OR MASON-WASP,
WITH NEST.
Odynerus flavițes.



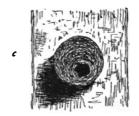


FIG. 194. a. MASON WASP.

Eumenes fraterna.
b. Nest of Eumenes Fraterna,
c. Nest of Eumenes.

including the bureau drawers, closed with mud. The wasps have been known to build in the hollow of a spool, and in the folds of a paper. When they have found or made a suitable cavity, they divide it into cells by mud partitions, place in each cell some food and an egg, and close the mouth of the cavity with a ball of mud. Sometimes the nest contains only one cell. One species makes a nest shaped like a broad, flat vase, and fastens it to a twig. Another makes a row of little mud balls about the size of cherries, each containing a single cell, and attached to a twig by a short, strong stem. The wasp has a short, pointed abdomen joined to the thorax by a pedicel so very long that you will readily recognise the species after you have once identified Still another mason-wasp makes a ball of mud as large as a hen's egg, containing many cells, and plasters it to the branch of a bush or tree. Solitary wasps live on other insects, and provide the same food for their young.

The Guest-wasps are found only in the south-west, and almost nothing is known about them.

The Digger-wasps are a group of solitary wasps, so called because they all make a home by digging, either in wood or in the ground. They are different in some ways from other wasps having the same habit; they do not collect pollen, and therefore have no baskets on their hind legs,

as honey-bees have; and their wings when at rest lie flat, while those of true wasps lie in folds.

The commonest species is the dark, mineralblue wasp, with his abdomen and thorax con-

nected by a Mud-wasp. Mud-dauber. long stem, called a ped-The nests consist uncle of a series of cells plastered side by side on ceilings and other flat under surfaces, and though the wasps are solitary, you will often find the nests in great numbers. On the plastered ceiling of a very long, old-fashioned piazza near my home, there are hundreds of them, and they are quite sure to be numerous in the garrets

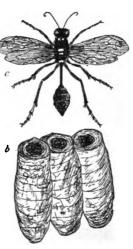


FIG. 195.

a. MUD-DAUBER, DIGGER-WASP, OR BLUE-JACKET.

Pelopaus lusatus.
b. NEST.

of country houses and under the roofs of barns. The mud-daubers provide spiders for their young. Like all *Hymenoptera* that provision their nests with insects, they sting the insect so that it is paralysed but still alive, and it re-

mains in that condition until the young wasp is hatched and ready to take food,—then he finds it waiting for him.

### FAMILY CHRYSID'IDÆ

There is one other family of Stinging Hymenoptera, called the Cuckoo-flies.



Chrysis nitidula.

name is given Cuckoo-flies. them because they lay an egg in the nest of a solitary wasp or bee, and leave it to be taken care of, as the cuckoo does among birds. The cuckoofly does not attempt to do

this when the bee or wasp is at home, for her reputation is too well known, but she is sometimes caught by their unexpected return, and treated as she deserves. If she lays her egg and slips away unseen, the owner does not know it, and seals the egg up in the cell with her own. The cuckoo-fly's egg hatches first, and the larva eats up the food stored in the cell, and often eats the little bee or wasp grub also. Cuckoo-flies look somewhat like wasps, but are rather broader in body. They are small, and very brilliant in colour, generally green or black.

#### **BORERS**

#### FAMILY TENTHREDIN'IDÆ

These take their name from the saws with which the female is furnished. She has two, set at the end of the abdomen, on Saw-flies. the under side, and she can push them out and in, and up and down. She uses them to make cuts in the leaves and twigs, within which she lays her eggs, sliding them down into the hole through the ovipositor, of which the saws form a part. The eggs grow after they are laid, as do those of ants. The larvæ are generally green, with marks of another colour. They look like the larvæ of moths and butterflies, but you can tell one from the other by the number of their pro-legs. True caterpillars have five pairs, the larvæ of saw-flies have from six to eight pairs. These larvæ are very harmful to vegetation. Currant and gooseberry bushes, turnips, sweet potatoes, wheat and corn, rose bushes, willow and other trees, have each its particular species of saw-fly. The larvæ are sometimes called slugs.

The Rose-slug makes brown skeletons of our Rose-slug. rose-leaves. He is yellow below, and green on his back. You will find him by

day lying quietly on the under side of the leaf, but at night he eats enough to make up for lost time. The fly is a tiny thing, with dusky, gauzy wings. There are two broods of Roseslugs every season.

This is a large species. The larvæ are common on willow, also on elm, birch, and other

trees. It is light yellow green, and has a black line down its back. The spiracles also are black. It lies curled up on the leaf, and if you an-

American Cim'bex. Willow Cimbex.

noy it, you will see it give out a fluid from

some glands just above the spiracles. Like the larvæ of saw-flies in general, it transforms in the ground. The fly is less than an inch in



FIG. 197. WILLOW CIMBEX.

AMERICAN SAW-FLY.

Cimbex americana.

length, though it is the largest common species. It has a black head, thorax, and legs, yellow feet, yellow antennæ with knobs at the ends, brownish wings, and yellow spots on each side of a dark bluish abdomen.

### FAMILY SIRIC'IDÆ

The insects of this family have a horn on the tail, and are therefore known as Horn-tails.

They are sometimes called Tailedwasps, but they are not wasps. The larvæ bore in the wood of trees, and do much harm.

The larva of this insect is a large, dirtywhite grub, found in various trees, especially

Pigeon in elm and Horn-tail. but ton-wood. The adult insect measures an inch and a half or more, from the tips of the antennæ to the tip of the horn on its tail. It has a black abdomen with broken bands of yellow, red



FIG. 198. PIGEON HORN-TAIL.

Tremex columba.

and black head, thorax, and antennæ, yellow legs and horn, and dusky wings. The ovipositor is a wonderful tool, and it will pierce solid green wood to the depth of half an inch. Sometimes it is driven in so hard that it will not come out, and the insect has to stay there till she dies.

### FAMILY ICHNEUMON'IDÆ

These are among our best friends. The female lays her eggs in or on the body of another insect, within which the larvæ live, devouring all the fatty portions, Ichneu'monwhile the insect grows weaker and weaker, and finally dies. Then the ichneumon-fly, fully grown, goes away to follow its own devices. Most ichneumons have honeyyellow bodies, but some are rust-coloured, some black, and some have yellow or black marks on the body. Their eyes are large and black, and the junction of the thorax and abdomen is so slender that it looks as if a touch would snap it in two. The antennæ are very slender, and are kept almost constantly in vibration. The adult ichneumons live only on the iuices of flowers.

No popular name has been given to this species. The fly has a slim body two and a half inches in length, long antennæ, and an ovipositor measuring three or four inches. The extreme length from tip to tip is almost ten inches. The ovipositor is like a hair, and two other hairs on either side form a covering for it; but slender and weak as it looks, the ichneumon-fly

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can bore a hole in solid wood, half an inch deep. She is the especial enemy of the Pigeon Horn-tail, and when she finds a tree in which the horn-tail has made a burrow, she drives her ovipositor straight into the wood, drops an egg into the horn-tail's nest, and departs, un-

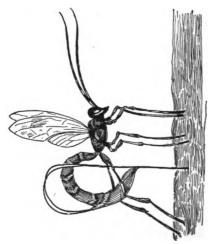


FIG. 199. ICHNEUMON-FLY.

Thalessa lunator.

less, as sometimes happens, she cannot pull her ovipositor out again. In that case she is compelled to die there. She rarely makes a mistake in the place she selects. The egg hatches in due time, and the little larva attaches itself to the horn-tail larva, and kills it. Then it remains in the burrow until it becomes an adult, when it crawls out and flies away.

The ichneumon-fly cuts a comical figure when drilling a hole. It swings its long ovipositor up over its body, and brings it down in a large loop, humps its abdomen almost into a ring, and with its long, crooked legs, its wings sticking straight up, and its antennæ straight forward, it wriggles and pushes its wonderful drill into the wood.

#### FAMILY BRACON'IDÆ

Perhaps you have seen a tomato-worm that looked as if its back were covered with grains

FIG. 200.

a. CATERPILLAR COVERED WITH BRACONID COCOONS.

b. BRACONID.

Bracon charus.

of rice, all stuck on end.

Brac'onids.

They were the cocoons of a tiny insect which laid its eggs within the caterpillar's body by means of its ovipositor. When the eggs hatched, the larvæ fed inside the caterpillar till they were grown, and then came out and made their cocoons on its back. Of course the

caterpillar soon died from weakness. When the pupæ were ready to appear as perfect insects, each one cut a tiny round lid from the top of its cocoon, and crawled out. These little parasites are found on other caterpillars, and sometimes you will see them bunched together on grass or weeds. The adults are usually bright-coloured, and look like small ichneumon-flies.

#### FAMILY EVANI'IDÆ

Another family of parasites has the abdomen growing from

the top of the last segment of the thorax, so that it stands up something like a stove-handle when it is left sticking in the lid.



FIG. 201. ENSIGN-FLY. Genus Fænus.

They have been called Ensign-flies, because somebody had a fancy that the abdomen was carried like a flag.

### FAMILY PROCTOTRU'PIDÆ

This family contains the smallest insect known, a little over six one-thousandths of an inch in length. It is dignified with the name of Alap'tus exci'sus. It is a parasite, as are most of the family. They are all tiny, black or brown creatures,

living on water-plants, in grass, and in hot, dry, sandy spots. Their eggs are laid within the eggs of other insects, or occasionally within the larvæ, or on the bodies of the adults.

#### FAMILY CYNIPIDÆ

These are the insects that make "oak-apples." If you cut some of these apples in two you will find them filled either with fibres, or with a woody substance, or with something soft and brown, as much like sponge



FIG. 202. a. GALL-FLY. DORSAL VIEW.

Amphibolips coccinea.

This gall-fly produces the Fibrous Oak-apple on the leaf of the scarlet oak.

b. GALL-FLY. LATERAL VIEW.

Amphibolips spongifica.

This gall-fly produces the Spongy Oak-apple on the red-oak or black-oak leaf.

as anything. At the centre there is always a space, within which lies the larva of the little creature that made the apple. The perfect insect is called a Gall-fly. It has a queer-shaped abdomen, almost like a ball, with the segments crowded as if it had been

shortened by being "telescoped." The ovipositor is long and slender, and is kept partly coiled up when not used. The eggs are laid in a puncture made in a leaf or stem, and as soon as the tiny reddish larvæ begin to eat, the galls begin to grow. Every species of gall-fly makes a different kind of gall. Most galls are found on oaks.



FIG. 203. OAK-GALL OR OAK-APPLE, MADE BY A GALL-FLY (Amphibolips coccinea), ON LEAF OF SCARLET OAK.

This is a large gall, sometimes two inches Fibrous Oak-in diameter, found on the scarlet apple. oak, so called from the brilliant red of its autumn foliage.

Another common kind is about the size of a large pea, or a bullet. It is hard Bullet-gall. and woody.

This is the kind that has a brown, spongy interior. It occurs on red oak and Spongy Oakblack oak.

apple.

This is a gall found quite often on black-berry stems. It is woody, and grows to a large size. It contains a berry-gall. number of cells, with a gall-fly larva in each.

There are some members of this family that do not make galls, and there are many insects not belonging to this family that do make galls, but you need not make any mistake, because the galls made by other families always have a hole left for the young to come out, while those of the gall-flies have no opening at all, and the new insect must make a door for himself when he needs one.





## ORDER ORTHOP'TERA

(STRAIGHT-WINGS)

THIS order contains six families, divided into the Graspers, the Walkers, the Runners, and the Jumpers. The Orthoptera have four wings. The hind wings are thin, and when at rest are folded under the front wings. The front wings are thick, and full of veins, and are called teg'mina. The mouth-parts are for biting. The young are called nymphs.

## **GRASPERS**

## FAMILY MAN'TIDÆ

The Grasping Orthoptera are made up of this one family, known as the Praying Mantes, and in the South as Mule-killers. They are found almost exclusively in warm climates, but they do not kill mules nor any other creature except the insects upon which they feed. They are curious, uncanny things. The front segment of the thorax is very long and slender,

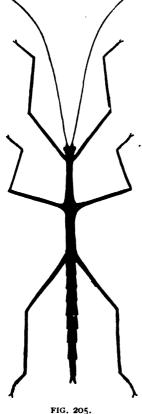


FIG. 204. PRAYING MANTIS.

Phasmomantis carolina.

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like an overgrown neck; the fore legs are large, and fitted for seizing prey; and the eyes



WALKING-STICK.

Diapheromera femorata.

are large and extremely prominent. The fore legs are also furnished with a row of spines for piercing and crushing insect prey.

## WALKERS

## FAMILY PHAS'MIDÆ

The Walking Orthoptera comprise only the curious insects known as Walking-sticks, meaning not sticks to walk with. but sticks that walk. The insects have so strong a resemblance to brown and green twigs and stems that it takes a sharp eye to detect them when they are at rest. The body, legs, and antennæ are long and slender. Our one common species has no wings,

but the tropical species have wings that look

precisely like leaves. They walk slowly and awkwardly. The middle pair of legs is the shortest. They feed on the leaves of trees and plants.

## RUNNERS

#### FAMILY BLAT'TIDÆ

These are the Running Orthoptera. They do their running at night, in kitchens and

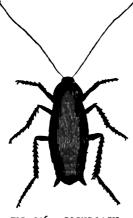


FIG. 206. COCKROACH.

Blatta orientalis.

storerooms, coming out of their hiding-places after the house is quiet, and devouring anything at hand in the way of food. They often leave a very offensive odour behind them. They are most troublesome in basements and damp places, and are commoner in the city than in the country. The ordinary large black

species is called in England the Black Beetle. Our native species do not come into our houses, but live outdoors in fields and woods, and make no trouble for anybody.

This is a small species, light brown in colour, originally brought from Europe, and often abundant round water-pipes in city houses.

# JUMPERS FAMILY ACRID'IDÆ

The Short-horned Grasshoppers are known as Locusts. Their antennæ are shorter than the body, and rather stout, and their bodies are thick and solid. They have on each side of the abdomen a round plate, supposed to be an ear. The wings, when at rest, meet above the back in two slopes like the roof of a house. The ovipositor is short. Many of the males can produce sounds, either by scraping the hind legs against the edges of the fore wings, or by rubbing the fore wings and hind wings against each other. They make their music only while in flight.

This is our commonest species, and is found

all over the United

Red-legged or Redthighed Locust. States.
It has a plump grey and

green body, red legs,
and brown wings
with a broad lemon-yellow band.

FIG. 207. RED-LEGGED OR RED-THIGHED LOCUST. Melanoplus femur-rubrum. This species looks just like the last except that it has longer wings; but unlike it, it is a terrible pest in some of our western States, where it is called, with Mountain good reason, the "Hateful Grasshopper." It moves in immense swarms, darkening the light of day, eating every green, growing thing in its path, and leaving the ground full of eggs to hatch the next year.

The species found in tropical countries are even more destructive. If a stream of water lies in their way, they crowd into it till the dead make a bridge for the living. If a fire is kindled before them, they push into it until their dead bodies extinguish it. They have been seen covering the ground to the depth of two feet, and have been met at sea twelve hundred miles from land.

You can recognise this common species by the crackling noise it makes as it flies, like the sound of the "bones" played by a distant boy. Only the males can make this noise, and they do it by rubbing the hind legs on the fore wings. The locust is a dull mottled brown. You will see it mostly in the fall, in grassy fields,

#### FAMILY LOCUS'TIDÆ

You must be sure to remember that no Locusts belong to this family. The giving of the name is to be regretted, but it can scarcely be helped now. The Long-horned Grasshoppers have very slender antennæ, always longer than the body. If they have external ears at all, they are situated, not on the abdomen, as in the locusts, but on the fore legs. The ovipositor is long and sword-shaped. The males make a loud sound by rubbing the wing-covers together. The wings meet at an angle, like those of the locusts. These grasshoppers do not migrate, nor live in swarms. They die when cold weather comes. Their colour is generally green, and it runs through the body, inside as well as out, as if the grasshopper had been dyed. The name of Green Grasshoppers is often applied to the family.

Meadow Grasshoppers. species of these, living in meadows and wet lowlands.



FIG. 208. MEADOW GRASSHOPPER, Genus Xiphidium.

These have no wings, and the body looks as if it had been cut off short at the hind end.



FIG. 209. CRICKET-LIKE GRASSHOPPER. Genus Ceuthophilus.

Cricket-like Grasshoppers.

Some species have no eyes, but they are found only in caves,

where the insects have no use for sight. They are colourless, also, from living in the dark. The members of this group are much like crickets in shape.

This group is so named because the thorax is covered by a kind of horny saddle or shield. These grasshoppers have very long, strong hind legs, and the same chopped-off look as the last group.

They are wingless, also. They look a little like crickets both in shape and colour.



FIG. 210. SHIELD-BACK GRASSHOPPER. Genus Thyreonotus.

This is the most familiar group of Longhorned Grasshoppers. They are long, slender

creatures. of Katydids, lovely light green colour, even to their eyes, found sometimes on bushes in the daytime, but moving about and singing only at night. They do not appear till midsummer or later, and there is a popular notion that the song of the first Katydid means "six weeks to frost." As a matter of fact, they are generally not far out of the way in their prediction. The Katydid lays about twenty long, slate-grey eggs, and glues them to a twig in two rows.



FIG. 211. COMMON OR BROAD-WINGED KATYDID. Cyrtophyllum concavum.

## FAMILY GRYL'LIDÆ

There are three groups of crickets, the True Crickets, the Mole Crickets, and the Tree Crickets. The first are the brown or black crickets of all sizes that we find everywhere, indoors and out. Most people love to hear their shrill, cheery call,

but they have a well-earned reputation for eating holes in damp woollen garments. They do this to get the moisture, of which they are very fond. Mrs. McNair, in Seaside and Way-side, says they will drink anything, water, milk, soup, tea, vinegar, beer, yeast, and even ink, but that proves too much for their digestion.

They do not live through the winter unless they find snug quarters in the house or in some well-sheltered spot. They are



FIG. 212. TRUE CRICKET.

Gryllus abbreviatus.

often troublesome about bakers' shops. They lay their eggs in the ground, two or three hundred in one mass. They hatch in July, and the young crickets attain their full growth in a few weeks. They feed chiefly on plants, grass-roots, and fruit, but sometimes on other insects.

The Mole Crickets burrow in the ground near water. They have broad, strong fore legs, and feet almost like hands, but no wings worth mentioning. They are a nuisance where they abound, because they eat the growing roots of plants. They eat insects

also, and dig galleries underground in search of them. The Mole Cricket lays several hundred eggs in a hole near the surface of the



FIG. 213.

MOLE CRICKET.

Gryllotalpa borealis.

ground, where the sun's heat will reach them, and then stays near to protect them from enemies.



FIG. 214.

SNOWY CLIMBING OR

TREE CRICKET.

Ecanthus niveus.

Among the Tree Crickets the commonest is the Snowy Tree Cricket, a small insect, with long antennæ, long hind legs, and delicate gauzy wings. The male is an ivory white, and the female has a greenish tint. This species is sometimes called the White Climbing-cricket. Unlike other species, it is often found on trees, and also in grass and bushes. It is not very common in the far north.

The females of all crickets have a long, sharp ovipositor, like a spear. The males have quite a complex musical instrument by which they produce their call. The sound is made by the vibration of the wing-covers, each one having a file-like edge which is scraped against a hard surface of the other. The wings of crickets lie flat above their bodies when at rest, but they seldom attempt to fly.





## ORDER DIPTERA

(TWO-WINGS)

THIS order is divided into two sub-orders, one including those flies which escape from the pupa through a T-shaped opening on the back, and the other those that escape by pushing out the front end of the puparium or larval skin, leaving a round hole. There are twenty-eight families in the first sub-order, and ten in the second. The number of species is very great.

The Diptera have only two thin, gauzy wings, either naked, hairy, or, rarely, bearing scales. In place of the hind wings there are short, thread-like organs, knobbed at the end, called halte'res, the use of which is not definitely known. The mouth is formed for sucking, sometimes for piercing also. The larvæ are called maggots-; they have no legs, and often no distinct head. Only a few make cocoons. Some are vegetable-eaters, some are carnivorous, and many are scavengers.

## FAMILY CULICIDÆ

Mosquitoes breed in stagnant water, especially rain-water. The eggs are laid in a mass that floats on the water like a raft. Mosquitoes. They are long and slender, and stand up side by side. After a few days the larvæ crawl out from the bottom of the eggs, and are known to us as "wigglers." They breathe through a hole near the end of the abdomen, and when they float on the water it is always head down, with this hole above the surface. The larvæ soon become pupæ, and in a few days more these transform to perfect insects, whom we know only too well. The females only can sing or sting; the males live in the woods and do not even enter our houses. We associate mosquitoes with hot days and nights, but they are abundant in the Arctic regions, and are one of the most terrible pests in Alaska.

## FAMILY MYCETOPHIL'IDÆ

These insects look a good deal like mosquitoes, but they make no sound, and they do not sting. They live on decaying vegetable matter and on fungi, both as larvæ and as flies, hence their name. The larvæ of one genus of this family

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are very gregarious, that is, they collect in immense numbers, being sometimes found in great masses under the bark of trees. When fully grown they seem to be moved by a desire to go somewhere, and off they start in a solid procession, two or three inches wide, several feet long, and at the deepest five or six worms deep. The worms at the hind end of the line are continually crawling over the others to reach the front, and that is how the procession moves. They do not get ahead very fast in this queer way; an inch a minute is about their average rate of speed.

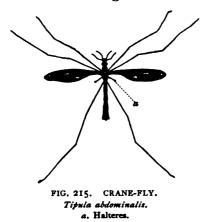
#### FAMILY CHIRONOM'IDÆ

This is another family sometimes mistaken for mosquitoes. You will see them early in the spring, while snow still lies on the ground, dancing in the air in swarms. Some are larger than mosquitoes, and some are smaller, but only a few of them can bite. Those that can are very tiny midges, so tiny that they can scarcely be seen at all, and the pain they inflict by their bite is out of all proportion to their size. They are extremely troublesome at dusk, or in certain localities, and at certain times of the year. Tourists

and sportsmen in the Adirondack Mountains are much annoyed by them. They are called Punkies. The larvæ of midges are sometimes found in salt water, but generally in fresh. Some are abundant in stagnant water, lying at the bottom, where they look like tiny red threads. I have often seen them in rainwater barrels, and in horse-troughs that were seldom cleaned.

## FAMILY TIPU'LIDÆ

Like the midges, the Crane-flies often appear in swarms at nightfall, and dance up and down



Crane-flies.

in the air. They have immensely long legs, which they use awkwardly, a slim body, and narrow wings. The ovipositor is long and horny. The eggs are

laid in the ground, a few in a place. These flies are most abundant in early spring.

## FAMILY TABAN'IDÆ

To this family belong the flies that so torment our horses in the summer-time, espe-

cially if we are driving through a bit of woods. They attack cattle also, and sometimes men.

This species is large, black, and covered with a whitish powdery substance. It measures nearly two inches across when its

wings are spread.



FIG. 216.
MOURNING HORSE-FLY.
Tabanus atratus.
(Slightly enlarged.)

This is the commonest species of the family. It is much smaller than the last. It has a white line down the back of the abdomen, and a large bright green head. It is a terrible pest in hot, sunny, summer weather, sometimes worrying cattle and horses to death on the western prairies. It bites human beings also, and to some is poisonous. On cloudy days it does not go abroad, and with the first frosts of autumn it dies.

This is a still smaller species. It includes those flies with spotted wings, that cling to a



FIG. 217. BLACK GOLDEN-EYED FLY. Chrysops niger.

horse's neck and Black ears, often a dozen Golden-eyed at a time, and stay fill they are gorged with blood, or till some friendly hand relieves the poor beast of the pests.

Horse-flies are very swift; no horse can outrun them. The females do all the mischief, the males living on sweets of flowers and trees.

## FAMILY ASIL'IDÆ

These are fierce, strong, swift flies; they can even overcome insects as large as dragon-



FIG. 218. ROBBER-, HOR-NET-, OR HAWK-FLY. Asilus sericeus.

flies and as Robber-flies. quick and brave as tiger-beetles. They have a long proboscis with which they pierce their prey. Some of them look like bumblebees, being hairy and striped black and yellow, but most are long and

slim. They fly with a humming noise. They

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are also called Hawk-flies and Hornet-flies. One species feeds on honey-bees, seizing them as they fly back and forth, and is known as the Bee-killer.

## FAMILY CECIDOMYI'IDÆ

The members of this family are so small that a beginner will not be likely to be interested in them, but one species makes a home for itself so conspicuous and so curious that you will be sure to see it sooner or later. This is the gnat that makes coneshaped galls on certain willow trees. The cone is always at the end of a twig. The little gnat makes the incision for its egg at the very tip of the leaf-bud, and the stem stops growing, but the outer leaves keep on and crowd up around the gall till it takes the shape of a short, thick pine cone. At any time in summer or winter, if you cut one of these cones in two, you will find at the centre a tiny legless maggot of a red or yellow colour. In the spring it changes to a pupa, and then to a gnat, just in season to begin a gall for itself on a tender willow tip. This is known as the Pine-cone Willow-gall.

Another species of gnat makes a different

gall called a Cabbage-sprout gall, a crowded cluster of curled and stunted leaves.



FIG. 219. PINE-CONE WILLOW-GALL ON LEAF OF HEART-LEAVED WILLOW (SALIX COR-DATA); MADE BY A GALL-GNAT. Cecidomyia strobiloides.

The Hessian-fly, so destructive to wheat, belongs to this family, but it does not make a gall; it works in growing wheat-stalks. The eggs are laid on the young blade of the grain, and hatch in four or five days. The larvæ, which are tiny reddish maggots, crawl down and fasten themselves to the stalk just below

the surface of the ground, where they feed upon the sap. The adult fly is a dusky, gauzywinged creature, hardly more than an eighth of an inch long. The reason that they do so much injury is because they travel in large swarms.

There are various other galls made on willows, but some of them are caused by sawflies.

#### FAMILY MUS'CIDÆ

The common, too common, House-fly is a member of this large family, to which about a third of all flies belong.

The Blow-fly is another member, a great, buzzing, blue-bodied creature, against whom we have to guard our food so carefully. The female has many ingenious ways of depositing her eggs, and has been known to alight on a wire screen covering meat, and drop her eggs through the meshes.

The Horn-fly is a much-dreaded pest. It looks like a small house-fly. You will see it in summer on the cattle in the pasture, settled in great patches on their backs and around the base of their horns, almost the only spots where the animals cannot reach them.

The Stable-fly is another species that torments cattle and horses. It looks like the house-fly, but its mouth, instead of the hollow, fleshy proboscis with which the house-fly laps its liquid food, is fitted for piercing the skin and sucking the blood. It is the fly which bites us so when a storm is at hand, though at other times it does not often come into the house.

## FAMILY ŒS'TRIDÆ

This family includes other pests of domestic animals.

Bot-flies.

Breeze-flies.

This fly lays its eggs on the hair of the horse, which licks them off and swallows them with its food. They remain in the stomach till they change to larvæ, and then pass out with the dung,

Gad-fly.

NIG 220

FIG. 220. HORSE-BOT.

and finish their transformations elsewhere. The fly is pale yellow, with red spots on its body, and a black band on the thorax. The female has a long abdomen, and the end of it is bent under and forward. Otherwise the fly deal like a common honey-bee.

looks a good deal like a common honey-bee.

This fly lays its eggs on the hair of the ox or cow, whence they are conveyed to the stomach by the animal's tongue. Here Ox-bot.
Ox-warble. they change to larvæ, and then in some way (it is not known exactly how) they make their way to the flesh of the back and form lumps under the skin, in which they stay till ready to change to pupæ. Then they crawl to the ground and transform. You will often see these lumps on the backs of cattle in summer. The fly is black and hairy.

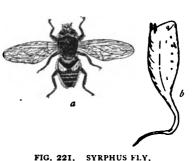
This is a dingy, mottled, grey fly. Its eggs are laid in the nostrils of the sheep, and the Sheep-bot. larvæ crawl up into the poor animal's head, causing a painful and dangerous disease known as "staggers." You may often see sheep, in hot summer days, standing in a circle with their noses to the ground to avoid the attacks of these torments.

## FAMILY SYR'PHIDÆ

Both adults and larvæ of this family vary so much in habits and appearance that you would find it hard to identify the different species, but there are certain forms of larvæ so curious that you will never forget them after you have once seen them. They are called Rat-tailed Maggots. Each one has a long, tail-like tube,

a continuation of the hind end of the body,

through which he breathes when buried in mud and water. This tube is adjustable as to length, and has a spreading tuft of hairs at the end to keep it afloat on the surface of the water.



Eristalis tenax.

a. Imago.
b. Larva: known as Rat-tailed Maggot.

I well recall my first acquaintance with these queer larvæ. An empty pork-barrel had been set out one spring under a tree behind a shed, and forgotten for some time. When I found it there were several inches of rainwater and decaying leaves in the bottom, and a colony of fat, white, long-tailed things, the strangest I had ever seen. I had a delightful time investigating the contents of the barrel, though it was years before I had access to books which told me what manner of creature I had discovered.

The *Syrphidæ* are bright-coloured flies, generally marked with yellow, and somewhat resembling wasps. They are in the main useful, because many of the larvæ feed on plant-lice.

## FAMILY PHOR'IDÆ

You can tell these flies by a great hump on the thorax, from which they are named. They are very small, nearly naked, black Hump-backed Flies. insects, abundant everywhere. The abdomen and head are tiny compared with the large thorax, and the wings are long. Sometimes the flies dance in swarms in the air, but you cannot tell them by this habit, because many other species do the same. They are often seen on window-panes.

Other easily identified species of different families are:—

Pomace-flies, little yellow flies found in great numbers about grape and apple pomace;

Dung-flies, yellow, hairy flies of small size, frequenting fresh cow-dung;

Apple-maggots, the common "railroadworms" that tunnel apples in all directions;

Stem-eyed flies, found on skunk-cabbage, that have their eyes set up on

pegs or horns, as crabs do;

Big-eyed flies, little flies found in shady places on low-growing plants. Their wings are much longer than their bodies, and their heads are all eyes. In the male



FIG. 222. BIG-EYED FLY. Genus *Pipunculus*.

the eyes are so large that they touch each other.

Another species, a metallic-green fly with yellow legs, is found in the pupa state in the alkaline lakes of our western country. Water so impregnated with potash that no other living thing is found in or about it, literally swarms with the larvæ of these flies. The Indians collect them, and use them, dried, for food. Mono Lake, in eastern California, is one of these lakes. Other flies of the same genus have been found in Labrador, and in salt water on our Atlantic coast. The name of the genus is Eph'ydra.





## ORDER NEUROP'TERA

(NERVE-WINGS)

THIS order formerly included ten of the nineteen orders accepted at present, but it now includes only seven families. The *Neuroptera* are biting insects, and they have four membranous, much-veined wings.

## FAMILY SIAL'IDÆ

The most famous member of this family is the Horned Corydalis. It is a large insect; its expanded wings sometimes measure Horned Comore than five inches across. The antennæ are stout; the mandibles, especially in the male, are very long and curved, crossing each other at about the middle. The female lays two or three thousand dull-white eggs, nearly the size of a radish seed, in a great mass, on stones or roots above the water of swift streams, into which the larvæ go as soon as hatched. They take al-

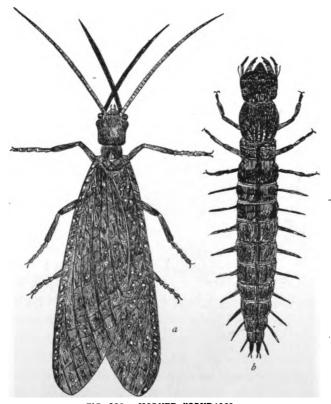


FIG. 223. HORNED CORYDALIS.

Corydalis cornuta.

a. Imago; male. Female has shorter mandibles.
b. Larva; known as Dobson, Sprawler, Hellgrammite, Water-centipede, etc.

most three years to attain their growth, during which time they live under stones in the water, feeding on the larvæ of other insects. They are ugly-looking creatures, but are much sought by fishermen as bait for bass and other fish. The fishermen call them Dobsons, sometimes Crawlers, or Clippers. The pupa state of the insect lasts about a month, but you can find the larvæ at any time in the year.

#### FAMILY MYRMELEON'IDÆ

You will find the Ant-lion oftener than any

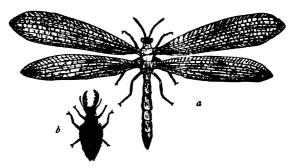


FIG. 224. ANT-LION, Myrmeleon formicarius.

a. Imago. b. Larva.

other member of this family. It is a trim

Ant-lion. little insect, with a long, slender body, narrow gauzy wings, and short legs and antennæ. It is not so well known,

however, nor so interesting, as its larva, an ugly, greedy, lively creature, with a savage pair of jaws and an endless appetite. With its head it digs a pit like a funnel, in fine, dry sand, and buries itself at the bottom, leaving only its mandibles in sight. As soon as any unwary insect slips over the edge of the pit, it slides down the steep, smooth side, sometimes assisted by a small avalanche of sand thrown over it by the "lion," till it reaches the bottom, where it is seized and devoured.

## FAMILY CHRYSOP'IDÆ

This is another family of "lions," Aphislions, feeding on aphids, or plant-lice. They are perhaps even more bloodthirsty than the ant-lions, for they do not hesitate to eat one another. The adults are called Lace-wings or Golden-eyes, their delicate wings being like changeable pale-green lace, and their eyes lustrous and golden. The body also is green, and the antennæ are brown. Their lovely colours fade after death. They fly at twilight or on moonlight nights. The eggs are laid on leaves, each egg on a stiff silk stem half an inch high. This is to prevent the first-born larva from eating up the unhatched eggs, as

he certainly would if they were left within his reach. The larvæ are as ugly as the ant-lions,



FIG. 225.

APHIS-LION, LARVA, AND
CLUSTER OF EGGS.

Chrysopa oculata.

but instead of lying in wait for victims they hunt them up and seize them with their strong, sickle-shaped jaws. These jaws are hollow, and the lion holds his prey between the tips, that the juices of the body may run through them. The aphislion will eat any insect that he can capture, but he prefers plant-lice, and the female often lays her eggs in the midst of an aphid

colony. It is said that in Europe gardeners hunt for the lions and place them on plants infested by aphids, great numbers of which they devour.





## ORDER MECOPTERA

(LONG-WINGS)

NE family makes up this order.

#### FAMILY PANOR'PIDÆ

They take their name from the abdomen of the male, which is long, slender, and curled under at the end, with an organ at Scorpionthe tip that looks like a pair of nipflies. pers, though it is harmless. The

head is prolonged into a beak like that of the snout-beetles, and has a biting mouth at the end of it. The antennæ and legs are long and slender. They have four yellowish wings with rusty black spots. The frequent damp, shady insects The eggs are laid in places. shallow holes in the ground, and

FIG. 226.

SCORPION-FLY. Genus Panorpa.

the larvæ look a good deal like caterpillars. They have not been fully studied, but are supposed to be carnivorous.



## ORDER TRICHOP'TERA

(HAIR-WINGS)

THIS is another order containing but one family.

These are common but very interesting insects, especially in the larval state. The adults are hairy, moth-like insects, fre-Caddis-flies. quenting water-sides. They have four large hairy wings, which when folded are laid almost flat against the sides of the body. The larvæ are called Caddis-worms. Cad-bait. Case-worms, and various other names, probably from the curious and varied cases made by the different species for their homes. The materials used are grains of sand or gravel, shells, tiny sticks, straws, bits of moss, dried grass-stalks, leaves, or roots, lined and fastened together with silk. Generally, the sticks or straws are laid lengthwise, but sometimes crosswise, or even endwise, sticking out in every direction. The shape is commonly like a tube, sometimes spiral, and in some cases tapering to a point like a slender cone. One species makes a little net of silk meshes, and

fastens it bet ween two
stones where
there is a swift
current. This
species does
not build a
case, but
makes a kind
of silk tube
between pebbles which it
fastens by

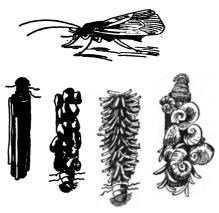


FIG. 227. CADDIS-FLY, AND NESTS. Family Phryganeida.

threads to the under side of a stone.

The Caddis-worm builds his house to fit himself. He can hide completely within it, or he can stick out his head and long front legs and drag it around with him as he crawls along the bed of the brook, and up and down the stems of water-plants. On the rear end of the body are little hooks by which the worm keeps himself from being pulled out of his case. He is very greedy, like other aquatic insects, and those species that are carnivorous eat a great many fish-eggs. Most species, however, live on plant food.



## ORDER SIPHONAP'TERA

THESE are the Fleas. They are famous leapers, having long, strong legs, especially the hinder pair. The body is hard, and bears many bristly spines which point backward. The mouth is made for piercing and sucking. The wings are wanting. The name of the order refers to this, apteros being Greek for wingless. Siphon, also a Greek word, means a tube, and refers to the tube-like mouth.

## ORDER EUPLEXOP'TERA

THIS order contains no other family. The name Earwigs is often applied to the long, slim, brown, many-legged creatures that hide under boards and stones, and sometimes come into dark, damp nooks in our houses, but these are not earwigs, nor even true insects. They are centipedes or millipedes; you will learn more about them

later. The real earwig is not often found in the northern part of the United States. It is a small insect, with a narrow body, short, leathery fore wings, like wing-covers, large hind wings,

folded when not in use, somewhat like a fan, antennæ like a row of beads, and a pair of saw-toothed nippers at the end of the abdomen that look very formidable under a microscope. Earwigs are charged with crawling into the ears of people who are asleep, but I have yet to Genus Forficula. hear of anybody who knows that they do. They



go abroad by night, hiding in flowers or foliage during the day. They live chiefly on plants.





## ORDER ODONA'TA

THE members of the single family included in this order are known as Dragon-flies, Devil's Darning-needles, Mosquito-hawks, Snakedoctors, etc. They are real dragons Dragon-flies. among insects, but absolutely harm-They devour mosquitoes, and all less to us. other insects as well, so that Insect-hawk would fit them better than Mosquito-hawk. As to the other names, there is no sense at all in them. Dragon-flies have a long, slim body, four strong, netted wings, a head composed chiefly of two enormous compound eyes, and a pair of powerful jaws. The hind wings are a little larger than the fore wings, and each fore wing looks as if it had been broken at the middle of the front edge, and had grown together again a little crooked. The wings cannot be folded, but always stick straight out, even when at rest. The mouths are made for biting. The colours are often very brilliant, but are apt to fade after death.

Dragon-flies are strong, swift, and greedy. The female drops her eggs into the water, a few at a time, as she skims over the surface, or leaves them on the stems of water-plants below the surface. She lays a large number, sometimes a hundred or more in all. Their colour is yellow or bright green.



FIG. 229. DRAGON-FLY.
Libellula trimaculata.

The larvæ are called nymphs. They are six-legged grey creatures, strong, active, and courageous, and are even more terrible dragons than their parents. They live at the bottom of ponds or streams, scurrying about after grubs, beetles, leeches, any living thing that they can grab with their hooked lower jaw and overcome. They are said to eat even shrimps and tadpoles. They live a year as

nymphs. When the time comes for the final change, they stop eating, seek the shallow water, and creep up the stem of some water-



Genus Agrion. (For nymph see Fig. 16.)

plant till they are far above the surface. Here they hook their feet firmly to the stem, and cling till the skin bursts along the back, and they crawl out. At first they are weak and flabby, and they remain motionless for an hour or so till they dry and harden; then they fly away, often leaving the shell in a perfect condition, except for the split by which they emerged. These cast skins are called exuviæ.

There are two distinct kinds of Dragon-flies. The second kind can and does fold its wings when at rest. FIG. 230. DAMSEL-FLY. It is smaller than the first kind, not so active nor so greedy, and for its quiet

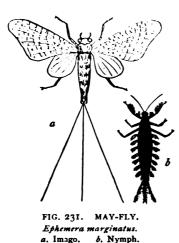
ways it is called by the French people the "Demoiselle," which we translate Damsel-fly.

Dragon-flies are most numerous in July and August. They do not live through the winter.



# ORDER EPHEMER'IDA

THE May-flies appear in May, June, and July, and you will soon learn to recognise them by two or three very long filaments, or threads, at the tip of a slender, al-May-flies. most transparent abdomen. wings are extremely delicate, gauzy, and finely The hind wings are much smaller netted. than the fore wings, and some species have no hind wings at all. The antennæ are so small as scarcely to be noticed, and the mouth-parts are wanting, for May-flies do not eat. live only a few hours or days, and then die. For this reason they are often called Day-flies. They are also known as Shad-flies, because they appear at the season when the shad are going up the rivers to lay their eggs. flies live in swarms, and are especially common in towns near streams or ponds. They are attracted by lights. When a little girl I lived in a city near Lake Winnebago, in Wisconsin, where, in the warm spring weather, I used to see the May-flies clinging in layers to the street lamps and objects near by. They used also to stick themselves all over fresh paint



and spoil it, if any man was so misguided as to paint his buildings at that time of year.

The larvæ are called nymphs, and are very different from the adults. The organs at the tip of the body are feathery instead of thread-like. Each side bears a row of fringed gills.

The nymph has six legs. It lives chiefly on insects, and moults a great many times, twenty times in some species, and once after its wings are fully developed, which no other insect does. These larvæ are used for bait by fishermen. They live under stones, or in mud, or among water-weeds.

# ORDER MALLOPH'AGA

These are wingless, biting insects, living Bird-lice. chiefly on the bodies of birds.

## ORDER CORRODEN'TIA

THE minute, almost colourless insects found in old books and papers are called Booklice. Look at one under a microscope and you will see that it has a plump body, a large head, long antennæ, and tiny black beads of eyes. Book-lice feed on paper, and sometimes do considerable damage to books, especially if stored in a damp place. They will also injure dried botanical specimens, and I have found them in a collection of insects, but could not see that they had done any harm.

FIG. 232.
BOOK-LOUSE.
Attropes divina-

## ORDER PLECOP'TERA

THIS name is given because the larvæ of these insects spend a good share of their lives under stones in swift streams. Their bodies are long, narrow, and taper stone-flies. Very little. They have large heads, and six stout legs, behind each of which is a gill that looks like a tuft of soft white hair. The antennæ are long and fine, and the abdomen has at the end two long bristles, or hairs, so that the nymph looks as if it had antennæ

at both ends of its body. It is greyish in colour, and lies very flat against the grey stones



FIG. 233. NYMPH OF STONE-FLY.

under which it hides. It has need to lie flat, for trout and other fish are extremely fond of these larvæ, and some species are much sought after by fishermen for bait.

The adult stone-flies have antennæ and caudal hairs like the nymphs. The hind wings are wider than the fore wings, and both pairs are finely netted. The mouth is incomplete, and it is supposed

that they eat little or nothing after they are full-grown. Their colour is a greenish grey. One species, black, with grey hairs, is common on the snow in early spring, and is called the Snow-fly.

# ORDER ISOP'TERA

THE only reason for calling these insects White-ants is that their habits are somewhat like those of ants. The two are otherwise in no way related, and the Termites are

not ants at all. They are found mostly in tropical countries, and our one North American species is commonest in the south,

FIG. 234. TERMITES. WHITE-ANTS. Termes flavipes. a. Soldier. b. Worker.

though it is found as far north as Massachusetts.

White-ants.
Ter'mites.

They live together in colonies, made up of workers with small, round heads and almost no jaws, soldiers with large square heads and strong mandibles, and a king and a queen, the father and mother of the whole colony. The latter alone have wings. The queen loses hers after she is ready to lay her eggs, and her body becomes greatly distended with the immense number of eggs it contains. She has been known to lay eighty thousand in one day. While in this condition she is helpless, and is taken care of

by the workers. These workers outnumber the soldiers ten to one. They are white, with waxy-yellow heads. The others are of various shades of brown, with a little yellow on the mouth and legs.

The termites found in the north live on the ground under stones, or in dead stumps and trees. All termites live in dark places. Those

of tropical countries build mounds of earth, called termitaria, often several yards in height and diameter. A termitarium contains a central chamber, with passages running from it in all directions. Some species build nests in trees. Others feed on wood, and are very destructive to buildings and furniture, because they bore in the framework till it becomes a mere shell.

## ORDER THYSANU'RA

THIS is the only order of insects that has no metamorphosis. The larvæ and adults are just the same except for size. They are very small insects, without wings.

Some species are called Spring-tails, because

they have long, stiff hairs at the end of the abdomen, which are bent forward under the body, and by means of which they can spring upward and forward to a great distance. They are found about heaps of manure, in barnyards, gardens, and hotbeds, on the surface of still water, and on the snow in spring. The latter

species is known as the Snow-flea, and is very common in northern New England. We children who used to haunt the maple-orchard in

sugaring time, were frequently called on to assist by straining snow-fleas out of the sap,

which was not the part we liked best.

Other species are known as Bristle-tails. One has two antennæ and three tailbristles, all five straight and stiff, and sticking out at different angles. This species is covered with silver-grey scales. It is fond of starch and paste, and will eat the starch in clothing and the

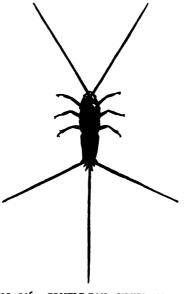


FIG. 236. BRISTLE-TAIL, SILVER-FISH, FISH-MOTH, ETC.

Lepisma saccharina.

paste in wall-paper, book-bindings, and photographs. It sometimes becomes a pest. It is known as Fish-moth, Fish-tail, Silver-tail, Silver-fish, Walking-fish, Silver-moth, Silver-witch, Furniture-bug,—you may take your choice of names. Bristle-tails are most commonly found where it is warm and damp, sometimes in houses, sometimes under stones and boards outdoors. They run very fast when alarmed.



# RELATIVES OF INSECTS SPIDERS

DERHAPS you will think that in telling you about the different orders of insects, I have forgotten spiders, but spiders are not insects, as you will see if you think a moment. Insects have a head, a thorax, and an abdomen; spiders have an abdomen, but the head and thorax are grown together, forming one part which is called a cephalo-thorax, meaning headthorax. Insects have antennæ; spiders have none. Insects have six legs; spiders have eight. The palpi, or true feelers, are often so much like legs that the spider appears to have ten legs, but he never has more than eight. Insects generally have compound eyes; spiders have only simple ones. These are usually eight in number, but sometimes six, four, or two. Spiders that live in caves have none. The eyes of spiders, like those of insects, are immovable, but are so arranged that they can see in all directions.

There are some points of resemblance, however, between spiders and insects. Both have their bodies and appendages made up of rings; both breathe through spiracles; both have two pairs of jaws, maxillæ with palpi attached, and mandibles, which, in spiders, have a poisongland at the tip. Like some insects, also, spiders are hatched from eggs, perfect in form, and grow without other change than moulting, which occurs very often while young. Their webs are often decorated with their cast skins. and you can find them at any time in windows or corners of out-buildings where the webs have accumulated. For these reasons spiders are said to be near relatives of insects, and as your collection will probably contain spiders, you will wish to know something about them.

An important part of a spider's outfit is its spinning machinery. Inside the body it has a store of fluid silk which, like the silk of a caterpillar, hardens at once on contact with the air. It is spun out through one or two pairs of little organs called spinnerets, situated on the under side of the abdomen, near the tip. Each spinneret has at the end a great number of tiny tubes finer than hairs, sometimes as many as two hundred, through which the threads pass. The spinnerets are movable,

# Insect Friends and Foes

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and sometimes jointed, so that the spider can spread them apart and spin a silk ribbon, or bring them together and spin all the little threads into one. It is hard to imagine anything so fine as a single strand of spider's silk. Many hundreds of them may be spun into a thread so small that it can scarcely be seen with the naked eye. It has been woven into cloth, like the silk of some caterpillars, and it is useful to stop the flow of blood from a cut.

A spider's supply of silk is limited. If its web is destroyed too many times the silk gives out, and the spider must go homeless, or steal from a weaker neighbour. It always prefers the latter course. All spiders spin silk, but not all make webs. Some use the silk to line their nests, some to make sacs to protect their eggs, and others to fly with, as we shall see later. Spiders that do not make webs, but roam about after their food, are called Vagabond Spiders; the others are known as Sedentary Spiders, because they sit in their webs and wait for prey.

Spiders are not social. They live either alone, or in pairs, and even two in a nest are pretty sure to have serious disagreements. The female is generally much larger than the male, and she treats him with great disrespect,

snapping off his legs without hesitation if she happens to be out of sorts, and eating him up when she wishes to get rid of him. The loss of several legs does not seem to interfere with a spider's activity or happiness; but new legs never replace the old ones, as in some orders of animal life. For obvious reasons, most of the spiders we see are females. The life of any spider does not exceed four years, and one year is the limit for most species.

The poison of spiders, which is sometimes, though very rarely, fatal to man, is more powerful, *in proportion to their size*, than the poison of any snake known.

## ORDER ARANE'IDA

Spiders all belong to this order. Our common species are arranged in eleven families.

## FAMILY THERIDI'IDÆ

The species we all know best, and perhaps like the least, are the small, slender-legged spiders

that spin their webs in our houses, in corners of rooms, on the under side of tables and chairs, and in every imaginable place where we do not wish them. We can easily believe that they belong to the largest family of spiders. This spider has very

Cobweb Weavers. House Spiders. Geometer Spiders.

ily of spiders. This spider has very long, slim

legs, a spade-shaped abdomen, two rows of eyes set well back from the front of the head,



FIG. 237.
COBWEB WEAVER.
Mimulus interfector.

and three branched claws on each foot. There are a great many other members of this family whom we do not know so well, because they live outdoors. Their webs are spun on bushes, and are flat, or perhaps sag a little in the centre. "Guy ropes" attached

to objects near by support the web, and serve as traps for heedless victims, and the owner hangs on the under side, waiting for them. Some species make a funnel to hide in, and some lie in wait in a convenient corner outside of the nest, but they are all on hand promptly when an insect strikes the net.

## FAMILY EPEI'RIDÆ

These are quite different in appearance from the Cobweb weavers. The eyes are close to the front of the head, and the spider is rather stout than slender; the abdomen is sometimes almost a globe domen is sometimes almost a globe in shape. The front legs are very long. These spiders are called Qrb Weavers, because their webs are nearly circular. They are the webs so abund-

ant in our gardens and fields, having a framework like an irregular wheel, with parallel lines covering the space between the spokes. The orb web is made of two kinds of silk. The spokes of the wheel, and the outside lines of various lengths which serve as supports, are of a dry silk that will not stretch. The rest is made of a sticky, elastic silk; sticky, that it may hold the insect that blunders against it; and elastic, that it may cause him in his struggles to become further entangled in the other lines.

When the spider has chosen a place for a nest, she spins a long thread and lets it hang and sway in the wind till the loose end catches on something. Then she draws it tight, and has a safe bridge from which to carry on her building operations. The outside supports are spun first. Then the spider attaches a thread to some point, and goes around the space to the opposite side, spinning as she goes, and holding the line up behind her with one or both hind legs, to keep it from tangling. When opposite the starting-point she draws the line tight and fastens it. Then she goes to the middle, attaches another end, carries it to a point an inch or two from the first, and makes it fast. These "spokes," called radii,

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are all spun in this way. Both the outside framework and the radii are made of dry silk. A small spiral, also of dry silk, is next made, beginning at the centre and extending out far enough to steady the radii, to each of which it is fastened. The spider then makes a second spiral, of sticky silk, for which all that has gone before is only a framework. This spiral is begun at the outer edge, and carried round and round, in close, parallel lines, toward the centre. When the first spiral is no longer needed, the spider gathers it up into little wads, and drops it on the ground. Also, when the web needs repairs, as it often does, the old threads are torn out and disposed of in the same way.

When the nest is completed, the spider waits, head down, near the centre or at the edge, keeping hold of one of the supports, that she may feel the vibration if an insect touches the web. The eggs are laid in clusters and covered with a silky sac. One orb weaver makes an egg-sac shaped like an ancient jar, or vase, with a globular body, a small neck, and a slightly flaring mouth. It is suspended in the midst of a network of threads, and contains in the fall several hundred eggs. As soon as these hatch, the spiders that are able to do so eat up the ones that cannot help

themselves, and in the spring only a remnant of the brood remains.

The garden spider of Europe is called the Diadem spider, or Cross spider, because it has on its back two bright-coloured marks forming a cross.

Another species common in our southern States is the Silk spider, so called because it spins silk very profusely. The difference in size between the sexes of this species is remarkable, the female being ten or twelve times as large as the male—as if, it has been estimated, a man should be six feet tall and a woman sixty or seventy.

## FAMILY ULOBOR'IDÆ

There are but two genera of this family in our country, one of which is not common, though it has been found in nearly every section. It weaves a circular web, parallel to the ground, and not far from it, much resembling that of the orb weavers, except that the spiral is made of a broad, curly ribbon instead of a thread.

The other genus is called the Triangle spider, from the shape of its web. Four lines, meeting at one end like four radii of a circle, form the framework, and the parallel cross-

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lines are double. The radii, at the end where they meet, are joined to a single strong thread, which is fastened to a support, as a hammock is swung by a rope at the end. The spider

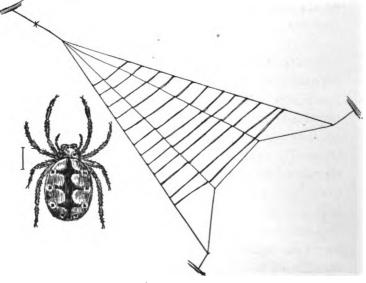


FIG. 238. TRIANGLE SPIDER.

Hyptiotes cavatus.

Web reduced about one-half. Cross indicates the spot where the spider rests while waiting for its prey.

takes her station on this single line, pulling on it so that it hangs slack between her fore legs and hind legs. The instant an insect touches the web, the crafty spider lets go the slack, and the sudden jerk of the line entangles the insect in the meshes. When one victim is secured, the spider hauls up her line again and waits for another. This species is found all over the eastern and middle States. It is said to like best for its home the dead twigs of pine or spruce.

#### FAMILY AGALEN'IDÆ

These are the spiders whose webs are so plentiful upon the grass on dewy summer mornings. Many people consider them a reliable sign of fair weather for the day; but the truth is that the webs are there all the time, and the dew only makes them visible. The spinners are brown spiders with very long legs,

two pairs of which are directed forward and two pairs backward. The legs bend sharply at the first joint, so that the body looks a lit-



FIG. 239. GRASS SPIDER. Agalena nævia.

tle as if it were swung in a framework of legs. The thorax is long, the abdomen hairy, globular, and pointed at the tip. One pair of the spinnerets is quite long, and can be seen plainly. These weavers make a silky web, with a funnel on one edge in which they hide

and sally out upon their prey. Like other funnels, it has a hole at the lower end, through which the spider retreats into the shelter of the grass if the web happens to catch the wrong kind of game. Other spiders sometimes provide themselves with funnels, but the true Funnel-weavers never hang back downward on the under side of the web, as the others do.

One species of this family, quite common in Europe, is called the Water spider, or Diving spider. It spins a house of silk, shaped like a diving-bell or a balloon, and attaches it, open end downward, to some plant under water. Here it lives, keeping its balloon filled with air, which it carries down on its body, a bubble at a time.

#### TUBE WEAVERS

There are two families called Tube weavers, from the long, circular nests they make for their winter quarters. The two families are much alike, but the Drassids are dark-coloured, long-bodied, stout-legged spiders, while the Clubionids are lighter in colour, short-bodied, with longer, slimmer legs. Neither of them spins a web. The Drassids hide on the ground all day, and seek their food at night. The Clubionids make their summer

nests of rolled leaves, lined with silk, and in

winter they make tubular nests under the bark of trees, or on the ground. The egg-sacs of the Drassids are the little, flat, silvery-white,





FIG. 240. TUBE WEAVERS.
a. Drassus saccatus.
b. Clubiona canadensis.

blister-like cases so common on stones.

## FAMILY LYCOS'IDÆ

These spiders are large. They have long, dark, hairy bodies, and large, strong legs.

They live on the ground under logs and stones. They do not make a web, but use their silk to line their nest. The nests are sometimes little

Running Spiders. Wolf Spiders.

tubes in the ground, within which the spider rests when not out looking for her meals. The top is either left open, or concealed by a cover made of bits of grass or twigs. One species, called the Turret or Tower spider, builds a tube-like structure over her doorway, two or

# Insect Friends and Foes

three inches high, like a tiny bird's nest without any bottom.

The eggs are enclosed in silken bags. The female Turret spider and others of the same

genus attach their eggsac to their spinnerets

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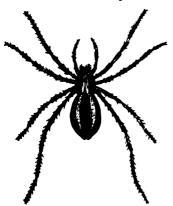


FIG. 241. RUNNING OR WOLF SPIDER. Lycosa punctulata.



FIG. 242.

NEST OF TURRET OR TOWER SPIDER.

Lycosa nidifex.

and drag it around after them, and also take care of their young ones for a few weeks after hatching, by carrying them about. I once counted fifty little black spiders riding on their mother's back across a road. As I came near, each little spider fastened a thread to its mother, and then jumped off and ran for shelter; but as soon as the danger was past they all found their way back by their threads, and

the mother did not go on till all her children were collected.

In another genus of the same family the female carries her egg-sac in her jaws till the eggs are ready to hatch; then she hangs it on a twig, spins a flimsy web about it for the youngsters to use till they are able to make a better one, and leaves them to themselves.

This family is rightly named, for they run very fast, and as they spread no web for their prey, they have need of nimble legs to catch it.

## FAMILY THERAPHOS'IDÆ

The Tarantula is a horrible, great, hairy, dark-coloured spider, much resembling in looks the running spiders just described. Tarantulas It makes its nest in the same way and Trapalso. But the tarantulas are much door Spiders. the larger family, and another difference is that the tarantula's jaws move up and down, instead of sidewise, as all other spiders' do. Some of them are so large that they catch and destroy small birds, from which they are called Bird spiders. They are found only in the warm parts of our country, South and West, and are sometimes brought here in fruit.

The Trap-door spiders belong to this family.



They dig a tube in the ground, as do the tarantulas and the running spiders, but they line it with a very tough, thick, silvery silk, and make a door like a lid with hinges. The tube is about the size of a half-dollar, and from eight to twelve inches deep, running at first straight down, but turning a little toward the end.

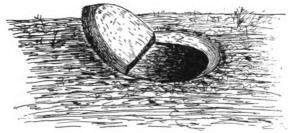


FIG. 244. TRAP-DOOR TO NEST OF A TRAP-DOOR SPIDER.

The door fits so tightly that even water cannot get in. It is made of two thicknesses of web filled in between with dirt, and the hinge also is of web. If the door is destroyed the spider rebuilds it, and will do so again and again. When she goes abroad she leaves her door wide open, knowing well, I suppose, that no intruder will be likely to trust himself inside the house; when she is at home the door is shut, and is sometimes concealed by moss or tiny growing plants which the cunning builder has placed there. If, when at home,

# Insect Friends and Foes

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she hears the least sound that alarms her, she springs to the door, fastens her mandibles into it, braces her legs, and holds on with such strength that it takes quite a pull to open it. These spiders stay at home by day, and work and forage only at night. A most interesting account of the "Insect Cave-Dwellers," by C. F. Holder, was published in *The Outlook* for February 12, 1898.

## FAMILY AT'TIDÆ

You will often find on grey, weather-stained boards of fences or buildings a small grey spider of exactly the same pepper-Jumping and-salt shade as the wood, with both body and legs short and thick. Two pairs of legs are directed forward and two backward. Two of the eight eyes are very prominent, and give one a curiously uncomfortable feeling of being stared at with evil intent. If you disturb this spider he will jump in any direction, forward, backward, or sidewise. He is active and strong, and he can make long jumps.

Some members of the family are black, and some have bright colours. When I was a little girl I used often to find the black ones around the wood-pile when I was picking up chips. They do not spin a web, but capture their prey by springing upon it. If a careless fly or bug alights near one of them, he does not jump directly at it, but he backs away slowly, not to alarm it, till he is out of sight over the edge of the board or sill. Then he runs along to a point just opposite the fly, fastens a thread to anchor by, and makes a quick, strong spring. If the insect is large enough it will often fly away and take the spider with it, but his thread holds them, and the poison from his bite soon weakens the victim so that he is able to conquer it.

## FAMILY THOMIS'IDÆ

Like the Jumping spiders, the Crab spiders can move in any direction, and they always go sidewise or backward in preference to going straight ahead. They are called crabs for this reason, and also because their bodies are short and wide, and their legs arranged a little like a crab's legs, spreading out and reaching forward, so that the effect of the whole is low and flat. They roam about after prey, and if alarmed will spin a thread and hang by it. One Misumona patin.

common kind is white, with a tinge of pink on the sides of the abdomen, and is found inside of flowers with its legs curled close to its body. Other species live on bark, and are grey or brown. In winter the crab spiders tuck themselves away in cracks and beneath stones. They do not spin a web.

## FAMILY DICTYN'IDÆ

This is a peculiar family in one respect its members possess an extra organ for spinning silk, called a cribellum, which Curledis situated in front of the spinnerthread Weavers. ets, and has tubes much finer than those of other spiders. They also have along each hind leg a row or two of spiny teeth. As the threads spin out of the cribellum the spider passes them over these spines, and combs them into a delicate, curly ribbon of silk, which he uses with the common, plain thread such as all spiders make. This curly ribbon is plainly to be seen in the web of a Dictynid, especially if there is any dust on the web. These spiders spin in any convenient place, and shape the web to its surroundings. They often choose a plant whose flowers grow in small, loose clusters, and enclose the whole plant within the web.

These are common in the fall, especially on warm days, when the air sometimes seems full

of the tiny threads by which they sail about. When one of them wishes to take a journey he crawls upon some object where he can get

Flying Spiders. Balloon Spiders.

a good start, spins a thread of silk, and lets it float out on the breeze. His instinct teaches him to choose a spot where the warm air, rising from the ground, will carry his thread upward, and he tries to help by raising the end of his abdomen as high as he can while spinning. When the thread is long enough the wind bears it away, spider and all, sometimes for many, many miles. The little creatures must go, I suppose, wherever the wind takes them, for they have no way of guiding themselves. They have been seen far out at sea. They are often called Aëronautic spiders. Perhaps the ones that go to sea should be called Argonauts.

# HARVESTMEN

Closely related to spiders, and by many people supposed to belong to the same order, are the Daddy-Long-Legs, well known to us all. They have broad, rounded bodies, greyish or cross-striped, eight very long, slim legs, two

eyes, two pairs of jaws, and one pair of spiracles for breathing. They cannot harm us if

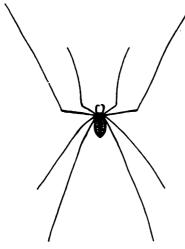


FIG. 246. GRANDFATHER GREYBEARD; DADDY-LONG-LEGS; HARVESTMAN. Phalangium dorsatum.

they would, and they would not if they could. Their food is plant-lice and other small insects, such as mosquitoes and flies, which they chew, instead of sucking as spiders do. Sometimes one daddy will eat another. Their proper name is Harvest-

men, and the children often call them "Grandfather Greybeards." They have always seemed to me remarkable for the ease with which they shed a leg or a piece of one, and for the disagreeable odour which they send out when crushed. The eggs are laid in the fall in cracks and under stones, and hatch in the spring.

## MITES

You will often find on the plants in your window, especially if the air of the room is

lacking in moisture, a tiny scarlet creature which nearly everybody calls a red spider. It is not a spider, however, but a Mite, and it sometimes appears in such numbers as to do considerable injury to plants, both indoors and out. Water is its greatest enemy, and a plentiful supply will soon drive it away. The plants, also, and your own lungs as well, need moisture in the air they breathe, so that frequent shower-baths on your house-plants will do good all around. To the family of mites belong also the tiny living things that are found in cheese, in raw sugar, and in other articles of food, and those that produce little swellings or galls on the stems and leaves of trees and plants, called blight, or blisters. Other mites called Ticks live on the bodies of insects and the higher animals, and others are the cause of certain skin diseases in human beings.

# SCORPIONS, ETC.

Among other insect relatives are the Scorpions, the Whip-scorpions, and the Pseudoscorpions, each constituting a distinct order. The first two are found only in hot countries, and you will not be likely to collect or study them. Of the Whip-scorpions there are two families, the Tailed and the Tailless. The

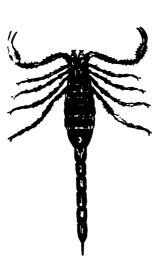


FIG. 247. SCORPION.

Buthus carolinus.



FIG. 248.
TAILED WHIP-SCORPION.
Thelyphonus giganteus.
(Less than one-half life-size.)

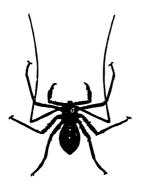


FIG. 249.
TAILLESS WHIP-SCORPION.
Genus Phrynus.



FIG. 250.
PSEUDO-SCORPION.
Chelifer obisium.

Pseudo-scorpions are found both North and South. They look a good deal like scorpions, but they have no sting in their tails, and they live on the smallest insects. They can run very fast, and, like crabs and some spiders, can move backward and sidewise. They are tiny creatures, and live outdoors under bark and stones, or indoors in dark, dusty places. Like the true scorpions they avoid the light. They are often found in old books, hunting for booklice, and are sometimes seen hanging to the leg of some larger insect, getting in this way a free passage from place to place.

# JOINTED SPIDERS

You may possibly find sometime what is called a Jointed spider, though it is not a spider,

but one more of the numerous relatives of insects, forming a small but distinct order. a queer-looking creature, very hairy, with eight legs and two leg-like palpi. Its body is in three segments, like those of true insects. It has two eyes, and two strong, pinching mandibles. It is not known to hunt (About one-half life-size.)



FIG. 251. IOINTED SPIDER. Genus Datames.

by day. It eats little insects, and, so far as known, cannot harm man. It is quite rare.

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# CENTIPEDES, MILLIPEDES

Insects have still other relatives, whose close acquaintance a beginner is not likely to make. The commonest are the Millipedes and Centipedes, better known as "thousand-legged worms," though you must not forget that they are not worms, for worms never have legs. These are generally light-brownish creatures, with distinct heads and two antennæ, but the rest of the body is in one long division made up of from six to two hundred segments, furnished with what seems to us a quite unnecessary number of legs. The millipedes have rounded bodies, and two pairs of short legs to each segment, while centipedes have flattish bodies, and only one pair of longer legs to each segment. Millipedes love dampness and decaying vegetable substances, and are found about leaky water-pipes and rotten wood, in cellars, and similar places. If frightened they coil themselves up closely. They do no harm to speak of, and have nothing to bite or sting Their movements are very slow. with.

Centipedes are not vegetarians; they live on insects, and some will eat earthworms. Their front pair of legs is different from the others, being fitted to seize their prey. They are also provided with poison glands by which they kill their victims, and in some species do serious injury to human beings. Centipedes

are found everywhere in the United States, but the large, venomous species live only in warm countries. My father, who spent many



FIG. 252. MILLIPEDE OR GALLEY-WORM. Genus Cambala.

years in South America, said that he never went to his bed at night without ransacking every corner of it, and never put on his clothes in the morning without turning or shaking them, lest he should be sharing them with a centipede; and one of the creatures, which he brought home to New England in a bottle of alcohol, contributed its share to many of my childhood's dreams.

The common northern centipedes are harmless. You will find them in various places, under loose bark and under stones in the woods, as well as in damp, dark places about

> FIG. 253. CENTIPEDE. Order Chilopoda.

buildings. If you crush one under your foot you will be astonished to see how little there

is left of him, generally nothing but a damp spot. You need not fear centipedes. If you

do not want them you will soon see that they do not want you, and they will get out of your sight as soon as they can. Do not kill them because they are not attractive. It is not their fault, and they are our friends, in that they eat insects, many of which are noxious. Some people call them earwigs, but the real earwig is a true insect with only six legs.

#### **CRUSTACEA**

The seven orders from spiders to jointed spiders, inclusive, make up the class called



FIG. 254.

FRESH-WATER CRAYFISH.

Genus Astacus.

Arachnida. Millipedes and centipedes, each a separate order, make the class Myriapoda. A third class of insect relatives is called Crustacea. It includes, among others, Lobsters, Crabs, and Shrimps, living in salt water, and Crayfish, or Crawfish, in fresh water. The latter are found in brooks, and I think they prefer those with a pebbly bottom, or one covered with small. loose stones. The stones make fine lurking-places, and the colour of the little crayfish is much like the bright brown

and reddish grey of our common pebbles. When I used to wade in the brooks I was in terror lest the crayfish should bite my toes, but I do not recollect that they ever did. We children called them crabs, but they are not crabs.



FIG. 255. SOW-BUG. Oniscus asel lus.

The only crustacean that you would ever mistake for an insect is the Sow-bug, a flat, oblong, brown or slate-coloured creature, with a good supply of antennæ and legs, that scuttles about frantically when you uncover his retreat under a damp board or a stone. He is a harmless, helpless thing.

#### **ARTHROPODA**

The four classes, Crustacea, Myriapoda, Arachnida, and Hexapoda, or insects, make up the largest branch of the animal kingdom, called Arthropoda. As this book is an entomology only, it will be sufficient to say here that the branch Arthropoda includes all animals whose bodies are composed of segments, some of which bear jointed legs. Other animals are made of segments, but lack the

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jointed legs; while others possess the legs, but are not segmented. It is only when they have both characteristics that they are called Arthropods.





#### BOOKS FOR REFERENCE

#### WITH NAME, AUTHOR, PUBLISHER, AND PRICE

- 1. Seaside and Wayside, Nos. I. and II. Mrs. Julia McNair Wright. D. C. Heath & Co., Boston and New York. Each about 25 cents.
- 2. Pictures and Stories of Animals, Book IV. Mrs. SANBORN TENNEY. Lee & Shepard, Boston. 35 cents.
- 3. First Book of Zoölogy. EDWARD S. MORSE. D. Appleton & Co., New York. \$1.10.
- 4. Manual for the Study of Insects. J. H. and A. B. Comstock. Comstock Publishing Co., Ithaca, N. Y. \$3.75.
- 5. Among the Moths and Butterflies. Mrs. Julia P. Ballard. G. P. Putnam's Sons, New York. \$1.50.
- 6. Injurious Insects of the Farm and Garden. Mrs. MARY TREAT. Orange Judd Co., New York. \$2.00.
- 7. Half-Hours with Insects. A. S. PACKARD. Henry Holt & Co., New York. \$1.50.
- 8. Guide to the Study of Insects. PACKARD. \$5.00.
- 9. Entomology for Beginners. PACKARD. \$1.75.
- Guides in Natural History, Nos. III, IV, and V. EDWARD KNÖBEL.

- 11. Insects Injurious to Vegetation. T. W. HARRIS. Orange Judd Co., New York. \$4.00.
- 12. The Insect World. Louis Figurer. D. Appleton & Co., New York. \$1.50.
- 13. Butterflies. S H. Scudder. Henry Holt & Co., New York. \$1.50.
- 14. Butterflies of North America. W. H. EDWARDS.
- 15. Riverside Natural History (formerly called the "Standard"), Vol. II. Edited by J. S. KINGSLEY. Houghton, Mifflin, & Co., Boston and New York. Six vols. \$30.00.

Of works on insects there is almost an endless number. All those named above are illustrated, most of them profusely.

For very young students Nos. 1 to 3 are most suitable. No. 3 is not a new book—it was first published more than twenty years ago—but is none the less accurate and attractive. It treats of other classes of the animal kingdom besides insects, but it is full of clear, simple illustrations which are intended to be copied as drawings by the little student.

As an all-around guide for the young entomologist, No. 4 is the best. It contains much that is technical and difficult for a beginner, but in the main it is simple and popular in matter and style.

Nos. 5 to 11 are excellent, each in its way, but are either less complete or less recent than No. 4.

Nos. 12 and 13 are for more advanced students.

Nos. 14 and 15 are valuable books, but so expensive that they are not likely to be found except in the larger libraries. No. 15 can only be purchased by the set of six volumes. No. 14 is published in two series, with plain or coloured plates, the latter at about \$40.00 per series.

There are many other books on entomology, most of which are valuable in one line or another, but no book can take the place of your personal study and observation of the specimens themselves. If you wish to learn a truth in the surest way, you must find it out yourself.





#### DIRECTIONS FOR MAKING BOOK-BOXES

HOOSE a soft, well-seasoned wood. Basswood is excellent, but almost any soft wood will answer except pine or similar wood containing resin. Take a piece five-sixteenths of an inch thick, and cut two strips two and one-fourth inches wide and nine long; and two strips of the same width, twelve and threeeighths inches long. Lay them down flat, and make a rabbet one-eighth of an inch deep and three-sixteenths wide, along each edge of each strip; and a rabbet one-eighth by five-sixteenths across each end of each long strip. The end of a short strip will then just fit the end rabbet of a long strip. Unless you have a rabbet-plane and know how to use it, you had better ask a carpenter to make the rabbets for you.

Put the strips together with good glue (not fish-glue), and before it is dry nail the corners with slender brads. When thoroughly dried the case is ready for a nine-by-twelve glass top and bottom. It is a good plan to lay the glass in place while the glue is drying, to keep the frame in shape. The inside of the box should be covered with tin-foil, or with a paint made of glue and zinc-white, in the proportion of one-fourth of a pound of glue dissolved in one and one-fourth pints of warm water, and the best zinc-white stirred in till the mixture is as thick as common paint. Use it before it gets cold. It dries immediately, and it never turns yellow. As soon as it is cold it hardens, but you can heat it and use it at any time.

Fasten strips of wood, one-half inch wide and one-fourth thick, lengthwise of the box, with strips of cork glued to the upper surface, to hold the pins. The number of these strips, or their distance apart, will depend on the kind of specimens the box is to contain. A little planning, with a little experience added, will settle this point. The strips may be just long enough to slip inside, and may be held in place by two or three small brads at each end, driven through the ends of the box. If you use only one brad the strip will be liable to turn.

The next step is to put in your specimens. Choose and arrange them carefully, for when the box is once completed and closed, it is a serious undertaking to open it.

Fasten the glass in with glaziers' points.

#### 344 Insect Friends and Foes

Cut a strip of marbled paper two and threefourths inches wide and about thirty-two inches long, and with well-cooked flour-paste lay it smoothly over the ends and one side of the box; the edges of the paper will cover the edges of the wood, and lap over on the glass. This will give a neat finish, and will help to make the box air-tight.

Fit to the unpapered side a thick piece of wood, rounding like the back of a book. Before fastening this on, paste to the box a piece of canvas or coat-stiffening large enough to lap over on the covers and serve as hinges. Glue the rounded back-piece in place, over the canvas.

Make two covers of heavy binders' board, large enough to project a little, like the covers of a book. Paste the hinges down on the inside of the covers. Cover the back of the "book," and the corners of the covers, with brown cambric, pasted smoothly. Cut marbled paper to fit the outside of the covers, and white paper to fit the inside, and paste both on neatly. You can add a fly-leaf of white paper if you wish, and a strip on the back will give the number of the volume and the order or genus of insects it contains. If you use ruled paper for the inside of the covers, you

can write on it an index of the specimens in the box.

Boards of any thickness, and glass of any size, may be used, and if you are mechanic enough to follow the directions given, you will easily see how to vary the dimensions to suit the size of the glass. Remember that the rabbets on the ends of the long strips must be as wide as the thickness of the wood used. The thin boards on which some kinds of dry-goods are wound make excellent material. In my neighbourhood they are obtainable from shirt factories at small cost. The marbled paper and binders' board can be found at book-binders' supply stores, possibly at printing-offices.

These directions may seem very complicated at first sight, but I am sure that an ingenious and persevering boy or girl can follow them, perhaps not without mistakes and failures at first, but successfully in the end. It will pay to take some trouble to learn, because if your collection ever attains any size, you will find the boxes for its proper accommodation no small item of expense.



# LIST OF POPULAR AND SCIENTIFIC NAMES.

A-che'mon Sphinx, Phi-lam'pe-lus a-che'mon.

Ai-lan'tus-worm, Phil-o-sa'mi-a cyn'thi-a.

Ambush-bugs, Phy-mat'i-da.

American Cim'bex, Cim'bex a-mer-i-ca'na.

American Copper, He-o'des hyp-o-phla'as.

American Dagger, Ac-ro-nyc'ta a-mer-i-ca'na.

American Lappet-moth, Phyl-lo-des'ma a-mer-i-ca'na.

American Saw-fly, Cim'bex a-mer-i-ca'na.

American Silkworm, Te'le-a pol-y-phe'mus.

American Tortoise-shell, Ag'la-is mil-ber'ti.

Angle-worm, Lum-bri'cus ter-res'tris.

Ant-lion, Myr-me'le-on for-mi-ca'ri-us. Ants, For-mi-ci'na.

Aph'ids, A-phid'i-da.

A'phis-lion, Chry-so'pa oc-u-la'ta.

A-pho'di-an Dung-beetles, A-pho'di-us.

Apple-maggot, Try-pe'ta pom-o-nel la.

Apple-tree Tent-caterpillar, Clis-i-o-cam'pa a-mer-i-ca'na.

Argus Butterflies, Sat-y-rina.

Argus-tortoise, Chel-y-mor'pha ar'gus.

Army-worm, Leu-ca'ni-a u-ni-punc'ta.

Ash-coloured Blister-beetle, Ep-i-cau'ta ci-ne're-a.

Asparagus-beetle, Cri-oc'e-ris as-par'a-gi.

Assassins, Red-u-vi'i-dæ.

Back-swimmer, No-to-nec'ta un-du-la'ta. Bad-wing Moth, Dys'pte-ris a-bor-ti-va'ri-a.

Bag-worm, Thyr-i-dop'te-ryx e-phem-e-ra-for'mis.

Baltimore, Eu-phyd ry-as pha'c-ton.

Banded Elfin, In-ci-sa'li-a ni'phon.

Banded Footman, Cis-the'ne u-ni-fas'ci-a,

Banded Hairstreak, Thec'la cal'a-nus.

Banded Purple, Bas-i-lar'chi-a ar'the-mis.

Banded Robber, Har-pac' tor cinc'tus.

Basket-worm, Thyr-i-dop'te-ryx e-phem-e-ra-for'mis.

Basswood Leaf-roller, Pan-tog'ra-pha li-ma'ta.

Beautiful Maple-borer, Plag-i-no'tus spe-ci-o'sus.

Beautiful Wood-nymph, Eu-this-a-no'ti-a gra'ta.

Bee-killer, Tru-pa'ne-a a-piz'o-ra.

Dees, Ap'i-da.

Beetles, Co-lc-op'te-ra.

Bella Moth, U-te-thei'sa bella,

Big Bed-bug, Co-nor-hi'nus san-gui-su'gus.

Big-eyed Flies, Pi-pun'cu-lus.

Bill-bugs, Ca-lan'dri-de.

Bird-lice, Mal-loph'a-ga.

Bird Spider, Lu-ryp'el-ma a-vic-u-la'ri-a.

Black Beetle, Elat'ta o-ri-en-ta'lis.

Black Breeze-fly, Ta-ba'nus a-tra'tus.

Black-c Owlet, Noc'tu-a c-ni'grum.

Black Damsel-bug, Co-ris'cus sub-co-le-op-tra'tus.

Black Golden-eyed Fly, Chry'sops ni ger.

Black-legged Tortoise-beetle, Cas'si-da ni'gri-pcs.

Black Swallow-tail, Pa-pil i-o po-lyx'e-nes.

Black Witch, Er'e-bus o-do'ra.

Blister-beetles, Me-lo'i-da.

Bloodsuckers, Red-u-vi'i-da.

Blood-sucking Cone-nose, Co-nor-hi'nus san-gui-su'gus.

Blow-fly, Cal-liph'o-ra vom-i-to'ri-a.

Boat-fly, Boat-insect, No-to-nec'ta un-du-la'ta.

Bombardiers, Bra-chi'nus.

Book-louse, At'ro-pos di-vin-a-to'ri-a.

Boring-bee, Xy-loc'o-pa vir-gin'i-ca.

Bot-flies, (Es'tri-dæ.

Breeze-flies, Ta-ban'i-dic.

Bristle-tails, Ci-nu'ra.

Broad-necked Pri-o'nus, Pri-o'nus lat-i-col'lis.

Broad-winged Katydid, Cyr-to-phyl lum con-ca'vum, Buck-moth, Hem-i-leu'ca ma'i-a,

Buffalo-bug, An-thre'nus scroph-u-la'ri-a.

Bugs, He-mip te-ra.

Bullet-gall, Hol-cas' pis glob' u-lus.

Bumble-bees, Bom'bus.

Bumble Flower-beetle, Eu-pho'ri-a in'da.

Burrowing-bugs, Cyd'ni-da.

Burying-beetle, Nec-roph'o-rus a-mer-i-ca'na.

Buttercup Oil-beetle, Mclo-c an-gus" ti-col lis.

Butterflies, Lep-i-dop'te-ra,

Cabbage Butterfly, Pi'e-ris ra'pa.

Cabbage Plusia, Plu'si-a bras'si-ca.

Cabbage-root Maggot, Phor'bi-a bras'si-cic.

Cabbage-worm, Pi'e-ris ra-pa.

Cad-bait, Caddis-flies, Caddis-worms, Phryg-a-ne'i-da.

Camberwell Beauty, Eu-va-nes'sa an-ti'o-pa.

Canker-worms: Spring, Pal-e-ac'ri-ta ver-na'ta; Fall, Al-soph'i-la pom-e-ta'ri-a.

Carolina Sphinx, Phleg-e-thon'ti-us car-o-li'na.

Carolina Tumble-bug, Co'pris car-o-li'na.

Carpenter-ant, Cam-po-no'tus penn-syl-va'ni-cus.

Carpet-beetle, An-thre'nus scroph-u-la'ri-æ.

Carrion-beetles, Lil phi-da.

Case-worms, Phryg-a-ne'i-da.

Cecropia moth, Sa'mi-a ce-cro'pi-a.

Centipedes, Chi-lop'o-da.

Cherry-tree Tortrix, Cherry-tree Ugly-nest Tortricid, Ca-cw'-ci-a cc-ras-i-vo-ra'na.

Chickweed Geometer, Ha-mat'o-pis gra-ta'ri-a.

Chinch-bug, Blis'sus leu-cop'te-rus.

Clear-wings, Se-si'i-da.

Click-beetles, El-a-ter'i-da.

Climbing Crickets, Œ-can'thus.

Clipper, Co-ryd a-lis cor-nu ta.

Cloaked Knotty-horn, Des-moc'e-rus pal-li-a'tus,

Close-wings, Cram'bi-da.

Clouded Locust, En-cop-tol o-phus sor di-dus.

Clouded Sulphur, Eu'ry-mus phi-lod'i-ce.

Clover Hypena, Hy-pe'na sca'bra. Clover Looper, Dras-te'ri-a e-rech'te-a. Cobweb-weavers, Ther-i-di'i-da. Coch'i-neal, Coc'cus cac'ti. Cockroaches, Blat'ti-da. Codlin Moth, Car-po-cap'sa pom-o-nel la. Colorado Potato-beetle, Do-ryph'o-ra dec-em-lin-e-a'ta. Common Katydid, Cyr-to-phyl lum con-ca'vum. Common Skippers, Hes-per-i'i-da. Common Stag-beetle, Lu-ca'nus da'ma. Common Tiger-beetle, Cic-in-de'la vul-ga'ris. Common Tumble-bug, Can'thon la'vis. Copper-spotted Cal-o-so'ma, Cal-o-so'ma cal'i-dum. Corn-louse Ant, Las'i-us brun'ne-us. Corsairs, Red-u-vi'i-da. Cotton-worm, A-le'ti-a ar-gil-la'ce-a. Cottony Cushion-scale, I-ce'ry-a pur'cha-si. Crab Spiders, Tho-mis'i-da. Crane-flies, Ti-pu'li-da, Crawler, Co-ryd'a-lis cor-nu ta. Creeping Water-bugs, Nau-cor'i-da. Crickets, Gryl li-da. Crinkled Flannel-moth, Me-gal-o-py ge cris-pa'ta. Cross Spider, E-pei'ra di-a-de-ma'ta. Croton-bug, Blat'ta ger-man'i-ca. Cuckoo-flies, Chry-sid'i-da. Curled-thread Weavers, U-lo-bor i-da. Currant-borer, Se'-si-a tip-u-li-for'mis. Currant Span-worm, Di-as-tic'tis rib-e-a'ri-a.

Daddy-long-legs, Phal-an-gid'e-a.
Daggers, Ac-ro-nyc'ta.
Damsel-bugs, Nab'i-da.
Damsel-flies, Ag'ri-on.
Darkling-beetles, Te-neb-ri-on'i-da.
Day-flies, Eph-e-mer'i-da.
Death-tick, Death-watch, An-o'bi-um no-ta'tum.
Devil's Darning-needles, Od-o-na'ta.
Diadem Spider, E-pei'ra di-a-de-ma'ta.
Digger-wasps, Sphe-ci'na.

Divaricated Bu-pres'tid, Di-cer'ca di-var'i-ca'ta.
Diving-beetles, Dy-tis'ci-da.
Diving Spider, Ar-gy-ro-ne'ta a-quat'i-ca.
Dobson, Co-ryd'a-lis cor-nu'ta.
Dog-day Harvest-fly, Ci-ca'da ti-bi'cen.
Dor-bugs, Lach-no-ster'na.
Dragon-flies, Od-o-na'ta.
Drop-worm, Thyr-i-dop'te-ryx e-phem-e-ra-for'mis.
Dung-flies, Sca-toph'a-ga.

Early Butterfly, Eu-va-nes'sa an-ii'o-pa.
Earth-boring Dung-beetles, Ge-o-tru'pes.
Earth-worm, Lum-bri'cus ter-res'tris.
Earwigs, For-fi-cu'li-da.
Egg-parasites, Proc-to-tru'pi-da.
Eight-spotted Forester, A-lyp'i-a a-to-mac-u-la'ta.
Engraver-beetles, Sco-lyt'i-da.
Ensign-flies, Ev-a-ni'i-da.
Ermine Moth, Spil-o-so'ma vir-gin'i-ca.
Evergreen Bag-worm, Thyr-i-dop'te-ryx e-phem-e-ra-for'mis.
Evergreen Cleora, Cle'o-ra sem-i-clu-sa'ri-a.
Eyed Brown, Sat-y-ro'des eu-ryd'i-ce.
Eyed El'a-ter, A'la-us oc-u-la'tus.

Feather-moths, Pter-o-phor'i-da. Fibrous Oak-apple, Am-phib'o-lips coc-cin'e-a. Fiery Hunter, Calo-so'ma cali-dum. Fire-flies, Lam-pyr'i-da. Fish-moth, Fish-tail, Le-pis'ma sac-cha-ri'na. Fish-worm, Lum-bri'cus ter-res'tris, Five-spotted Sphinx, Phleg-e-thon'ti-us ce'le-us. Flat-bugs, A-rad i-dx. Fleas, Siph-o-nap'te-ra. Flies, Dip'te-ra. Flour-beetle, Te-neb'ri-o mol'i-tor. Footman-moths, Lith-o-si'i-da. Forest Tent-caterpillar, Clis-i-o-cam'pa dis'stri-a. Forked Fungus-beetle, Bol-et-o-the rus bi-fur cus. Four-footed Butterflies, Nym-phal'i-da. Frog-hoppers, Cer-cop'i-da.

Fungus-gnats, My-cel-o-phil'i-da. Funnel-web Weavers, Ag-a-len'i-da. Furniture-bug, Le-pis'ma sac-cha-ri'na.

Gad-fly, Gas-troph'i-lus e'qui. Galley-worm, Chi-log'na-tha, Gall-flies, Cy-nip'i-da. Gall-gnats, Cec-i-do-my-i'i-de. Garden Spiders, E-pei'ri-da. Gartered Plume-moth, Ox-yp'ti-lus per-is-cel-i-dac'tyl-us. Geometer Spiders, Ther-i-di'i-da, Giant Silkworms, Sat-ur-ni i-da. Giant Skippers, Meg-a-thym'i-da. Giant Water-bugs, Bel-os-tom'i-de. Gipsy Moth, Por-the tri-a dis par. Goatweed Butterfly, A-na'a an'dri-a. Golden-eyes, Chry-so'pa. Golden Tortoise-beetle, Cop-toc y-cla au-ri-chal ce-a. Goldsmith-beetle, Co-tal pa la-nig c-ra. Gooseberry Span-worm, Di-as-tic tis rib-e-a ri-a. Gossamer-winged Butterflies, Ly-can'i-da. Grandfather Greybeards, Phal-an-gid'e-a. Grape Leaf-roller, Des'mi-a fu-ne-ra'lis, Grape-vine Ep-i-me'nis, Psy-co-mor'pha ep-i-me'nis. Grape-vine Plume-moth, Ox-yp' ti-lus per-is-cel-i-iac' ty-lus. Graspers, Man'ti-dæ. Grass-moths, Cram'bi-da. Grass Spiders, Ag-a-len'i-dæ. Grave-digger, Nec-roph'o-rus a-mer-i-ca'na. Great Spangled Frit'il-la-ry, Ar-gyn'nis cyb'e-le. Green Caterpillar-hunter, Cal-o-so ma scru-ta tor. Green Grape-vine Sphinx, Am-pe-loph'a-ga my'ron. Green Grasshoppers, Lo-cus'ti-dæ. Green-head Fly, Ta-ba'nus lin-c-o'la. Green-striped Maple-worm, Dry-o-cam'pa ru-bi-cun'da. Ground-beetles, Ca-rab i-da. Guest-wasps, Ma-sar'i-da.

Hair-wings, Tri-chop'te-ra. Half-wings, He-mip'te-ra.

Harlequin Milkweed Caterpillar, Cyc'ni-a eg'le. Harvestmen, Phal-an-gid e-a. Hateful Grasshopper, Me-lan'o-plus spre'tus. Hawk-flies, A-sil i-da. Hawk-moths, Sphin'gi-da. Hawthorn Tingis, Cor-y-thu ca ar-cu-a ta. Hell'gram-mite, Co-ryd'a-lis cor-nu'ta. Her'cu-les Beetle, Dy-nas'tes her'cu-les, Hermit Flower-beetle, Os-mo-der'ma er-e-mic'o-la. Hesperians, Hes-per-i-i na. Hessian-fly, Cec-i-do-my'i-a de-struc'tor. Hickory Tiger-moth, Ha-lis-i-do ta ca'ry-a. Hog-caterpillar of the Vine, Am-pe-loph'a-ga my ron. Honey-bee, A'pis mel-lif'i-ca. Hook-tip Moths, Dre-pan'i-da. Hop-merchant, Pol-y-go'ni-a com'ma. Horn-bug, Pas'sa-lus cor-nu'tus. Horned Corydalis, Co-ryd'a-lis cor-nu'ta. Horned Passalus, Pas'sa-lus cor-nu'tus. Hornet-flies. A-sil i-da. Hornets, Ves'pa. Horn-fly, Ham-a-to'bi-a ser-ra'ta. Horn-tails, Si-ric'i-da. Horse-bot, Gas-troph'i-lus e'qui. Horse-flies, Ta-ban'i-da. House-fly, Mus'ca do-mes'ti-ca. House Spiders, Ther-i-di'i-da. Humming-bird Moths, Sphin'gi-da. Hump-backed Flies, Phor'i-da.

Ichneumon-flies, Ich-neu-mon'i-da.
Ilia Underwing, Ca-toc'a-la il'i-a.
Imperial Moth, Bas-i-lo'na im-pe-ri-a'lis.
Indian Cetonia, Eu-pho'ri-a in'da.
Io Moth, Au-tom'c-ris i'o.
Isabella Tiger-moth, Pyr-rharc'ti-a is-a-bel la.

Jointed-spiders, Sol-pu'gi-da. Jumping Spiders, At ti-da. June-bugs, Lach-no-ster na. 353

Lace-bugs, Tin-git i-da. Lace-wings, Chry-sop'i-da. Lady-birds, Lady-bugs, Coc-ci-nel li-da. Large Carpenter-bee, Xy-loc'o-pa vir-gin'i-ca. Leaf-cutting Bee, Meg-a-chi'le bre'vis. Least Skipper, An-cy-lox'i-pha nu'mi-tor. Leopard Moth, Zeu-ze'ra py-ri'na. Lice, Ped-i-cu'li-da. Lightning-bugs, Lam-pyr'i-da. Locust-borer, Cyl-le'ne ro-bin'i-a. Locusts. A-crid i-da. Locust-tree Carpenter-moth, Pri-on-ox-vs'tus ro-bin'i-a. Long-beaks, Li-byth-e-i'na. Long-horned Beetles, Cer-am-byc'i-da. Long-horned Grasshoppers, Lo-cus'ti-da. Longicorns, Cer-am-byc'i-da. Long-legged Emesa, Em'e-sa lon'gi-pes. Long-tailed Skipper, Eu'da-mus pro'te-us. Long-tongued Bees, A'pi-da. Long-wings, Me-cop'te-ra. Luna Moth, Tro-pæ'a lu'na, Lyreman, Ci-ca'da ti-bi'cen.

Maia Moth, Hem-i-leu'ca ma'i-a. Many-plume Moth, Or-ne-o'des hex-a-dac'ty-la. Margined Blister-beetle, Ep-i-cau'ta ci-ne're-a. Marsh-treader, Lim-nob'a-tes lin-e-a'ta. Masked Bed-bug Hunter, Op-si-ca'tus per-son-a'tus. May-beetles, Lach-no-ster'na. May-flies, Eph-e-mer'i-de. Meadow-browns, Sat-y-ri'na. Meal-beetle, Te-neb'ri-o mol'i-tor. Meal-worm. Te-neb'ri-o mol'i-tor. Mealy-bugs, Dac-ty-lo'pi-us. Membrane-wings, Hy-me-nop'te-ra. Midges, Chir-o-nom'i-dx. Milkweed Butterfly, A-no'si-a plex-ip'pus. Millipedes, Chi-log'na-tha. Mites, Ac-a-ri'na. Modest Sphinx, Ma-rum'ba mo-des'ta.

Monarch Butterfly, A-no'si-a plex-ip'pus.

Mosquitoes, Cu-lic'i-da.

Mosquito-hawks, Od-o-na'ta.

Moths, Lep-i-dop'te-ra.

Mound-builders, Mound-building Ants, For mi-ca ex-sec-toi'des.

Mourning-cloak, Eu-va-nes'sa an-ti'o-pa.

Mourning Horse-fly, La-ba'nus a-tra'tus.

Mud-daubers, Mud-wasps, Pel-o-pa'us.

Mud-worm, Lum-bri'cus ter-res'tris.

Mule-killers, Man'ti-da.

Murky Ground-beetle, Har'pa-lus ca-lig-i-no'sus.

Negro-ant, For mi-ca sub-se-ric e-a.
Negro-bugs, Cor-i-me-læn i-dæ.
Nerve-wings, Neu-rop te-ra.
Nettle Tortoise-shell, Ag la-is mil-ber ti.
Nine-spotted Lady-bird, Coc-ci-nel la no-vem-no-ta ta.
Northern Cloudy-wing, Thor y-bes pyl a-des.
Notched-wing Geometer, En no-mos mag-na ri-us.
Nut-weevil. Bal-a-ni nus rec tus.

Oak-worms, An-i-so'ta.
Oil-beetles, Mel'o-e.
Olive Hairstreak, Mi-tou'ra da'mon.
Onion-fly, Phor'bi-a ce-pa'rum.
Orange-striped Oak-worm, An-i-so'ta sen-a-to'ri-a.
Orb-weavers, E-pei'ri-dw.
Orchard Tent-caterpillar, Clis-i-o-cam'pa a-mer-i-ca'na.
Owlets, Noc-tu'i-dw.
Ox-bot, Ox-warble, Hyp-o-der'ma lin-e-a'ta.

Painted Beauty, Painted Lady, Va-nes'sa hun'te-ra.
Painted Lady-bird, Har-mo'ni-a pic'ta.
Pandorus Sphinx, Phi-lam'pe-lus pan-do'rus.
Paper-wasps, Ves'pi-da.
Peach-tree Borer, San-ni'na ex-it-i-o'sa.
Pear-tree Borer, Æ-ge'ri-a py'ri.
Pennsylvania Soldier-beetle, Chaul-i-og'na-thus penn-syl-va'ni-cus.
Periodical Cicada, Ci-ca'da sep-ten'de-cim.
Pigeon Horn-tail, Tre'mex co-lum'ba.

Pine-cone Willow-gall, caused by Cec-i-do-my'i-a strob-i-loi'des.

Pine-Leaf Tube-builder, Lo-phod e-rus pol-i-ta'na.

Pine Sesian, Har-mo'ni-a pi'ni.

Pirates, Red-u-vi'i-da.

Pitch-pine Retinia, Re-tin'i-a com-stock-i-a'na.

Pithy Blackberry-gall, Di-as'tro-phus neb-u-lo'sus.

Plain Lady-bird, Coc-ci-nel la mun'da.

Plant-lice, A-phid i-da.

Plume-moths, Pter-o-phor'i-da.

Polyphemus Moth, Le'le-a pol-y-phe'mus.

Pomace-flies, Dro-soph'i-la.

Poplar Dagger, Ac-ro-nyc'ta a-mer-i-ca'na.

Poplar Mocha-stone Moth, Ich-thy-u'ra in-clu'sa.

Potato-bug, Do-ryph'o-ra dec-em-lin-e-a'ta.

Prairie Alligator, Em'e-sa lon'gi-pes.

Praying Mantis, Phas-mo-man'tis car-o-li'na.

Promethea Moth, Cal-lo-sa'mi-a pro-me'the-a.

Prominents, No-to-don'ti-da.

Pseudo-scorpions, Pseu-do-scor-pi-o'nes.

Punkies, Cer-a-to-po'gon.

Race-horse, Em'e-sa lon gi-pes.

Railroad-worm, Try-pe'ta pom-o-nel la.

Raspberry Geometer, Syn-chlo'ra glau-ca'ri-a.

Red Admiral, Va-nes'sa at-a-lan'ta.

Red-ant, Mon-o-mo'i i-um phar-a-o'nis.

Red bugs, Pyr-rho-cor'i-da.

Red-humped Apple-worm, Red-humped Prominent, Œd-e-ma'sı-a con-cin'na.

Red-legged Locust, Red-thighed Locust, Me-lan'o-plus fe'murru'brum.

Red Milkweed-beetle, Tet-ra-o'pes tet-ra-oph-thal mus.

Red-spider, Te-tran'y-chus te-la'ri-us.

Regal Moth, Cith-e-ro'ni-a re-ga'lis.

Ribbed Pine-borer, Rha'gi-um lin-e-a'tum.

Rice-weevil, Ca-lan' dra or'y-za.

Robber-flies, A-sil'i-da.

Rocky-mountain Locust, Me-lan'o-plus spre'tus.

Rose-bugs, Rose-chafers, Mac-ro-dac'ty-lus sub-spi-no'sus.

Rose-slug, Mon-as-te'gi-a ro'sa.

Rosy Dryocampa, Dry-o-cam'pa ru-bi-cun'da.

Rosy-striped Oak-worm, An-i-so'ta vir-gin-i-en'sis.

Round-web Spiders, E-pei'ri-da.

Rove-beetles, Staph-y-lin'i-da.

Royal Horned-caterpillar, Cith-e-ro'ni-a re-ga'lis.

Royal-moths, Cith-e-ro-ni'i-da.

Runners, Blat'ti-da.

Running-beetles, Ca-rab'i-da.

Running Spiders, Ly-cos'i-da.

Saddle-back Caterpillar, Em-pre'ti-a sti-mu'le-a.

Salt-marsh Caterpillar, Es-tig-me'ne a-cræ'a.

Satellite Sphinx, Phi-lam pe-lus pan-do'rus.

Satyrs, Sat-y-ri'na.

Saw-flies, Ten-thre-din'i-da.

Sawyer, Mon-o-ham'mus con-fu'sor,

Scale-bugs, Coc'ci-dæ.

Scale-wings, Lep-i-dop'te-ra.

Scalloped Owlet, Scol-e-op'ter-yx li-ba'trix.

Scallop-shell Moth, Cal-o-cal pe un-du-la ta.

Scorpion-Flies, Pa-nor pa.

Scorpions, Scor-pi-on'i-da.

Searcher, Cal-o-so'ma scru-ta'tor.

Seventeen-year Locust, Ci-ca'da sep-ten'de-cim.

Sexton-beetles, Nec-roph'o-rus.

Shad-flies, Eph-e-mer'i-da.

Sheath-wings, Co-le-op te-ra.

Sheep-bot, Estrus o'vis.

Shield-backed Bugs, Scu-tel-ler'i-da.

Shiner, Le-pis'ma sac-cha-ri'na.

Short-horned Grasshoppers, A-crid'i-da.

Short-tongued Bees, An-dren'i-da.

Silk Spider, Neph'i-la plu'mi-pes.

Silkworm, Bom'byx mo'ri.

Silver-fish, Silver-moth, Silver-tail, Silver-witch, Le-pis'ma sac-cha-ri'na.

Silver-spotted Skipper, Ep-ar-gy're-us tity-rus.

Six-spotted Tiger-beetle, Cic-in-de'la sex-gut-ta'ta.

Skiff Caterpillar, Eu-lim-a-co'des sca'pha.

Skin-beetles, Trox.

Skipiacks. El-a-ter'i-da. Skippers (Bugs), Hyd-ro-bal'i-da. Skippers (Butterflies), Hes-per-i-i'na. Siave-ant, For mi-ca sub-se-ric e-a. Slave-holder, Slave-holding Ant, For mi-ca dif-fic i-lis. Slug Caterpillars, Eucle'i-da. Small Carpenter-bee, Ce-rat'i-na du'pla. Snake-doctors, Od-o-na'ta. Snapping-beetles, El-a-ter'i-d.c. Snout-beetles, Rhyn-coph'o-ra. Snout Butterfly, Hyp'a-tus bach-man'i-i. Snow-flea, Ach-o-ru'tes ni-vic'o-la. Snow fly, Cap'ni-a pyg'ma-a. Snowy Tree-cricket, Œ-can'thus niv'e-us. Social Wasps, Ves pi-da Solitary Wasps, Eu-men'i-dæ. Sow-bugs, O-nis ci-da. Spanish-fly, Can'tha-ris ves-i-ca-to'ri a. Spectre, Spider-bug, Em'e-sa lon'gi-pes. Spiders, Ar-a-ne'i-da. Spiny Oak-worm, An-i-so'ta stig'ma. Spittle-insects, Cer-cop'i-da. Spongy Oak-apple, Am-phib o-lifts spon-gif i-ca. Spotted Horn-heetle, Dy-nas'tes tit'y-rus. Spotted Peliduota, Pel-id-no ta punc-ta ta. Spotted Thyris, Thy'ris mac-u-la'ta. Sprawler, Co-ryd'a-lis cor-nu'ta. Spring Azure, Cy-a-ni ris pseud-ar-gi o-lus. Spring-beetles, El-a-ter'i-da. Spring-tails, Col-lem'bo-la. Squash-bug, An'a-sa tris'tis. Stable-fly, Sto-mox'ys cal'ci-trans. Stag-beetle, Stag-horn Beetle, Lu-ca'nus da'ma. Stem-eyed Fly, Sphyr-a-ceph'a-la brev-i-cor'nis. Stick-bug, Em'e-sa lon'gi-pes. Stilt-bugs, Be-ryl'i-da. Stingers (Hymenoptera), A-cu-le-a ta. Stink-bugs, Pen-ta-tom'i-da. Stone-flies, Ple-cop'te-ra. Straight-bodied Pri-o'nus, Or-tho-so'ma brun'ne-um.

Straight-wings, Or-thop'te-ra.
Striped-bug, Di-a-brot'i-ca vit-ta'ta.
Striped Footman, Hy-po-pre'pi-a min-i-a'ta.
Swallow-tails, Pa-pil-i-o-ni'na.
Syrphus-flies, Syr'phi-da.

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